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THE PSYCHOLOGICAL AND EDUCATIONAL WORK OF GRANVILLE STANLEY HALL

By SARA CAROLYN FISHER
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The beginning and early growth of a differentiated science of psychology in America was the result chiefly of the efforts of three men,—William James, George Trumbull Ladd, and Granville Stanley Hall. Of these, the first two never broke with philosophy. In his *Psychology*, James' chapter and section heads are for the most part expressive of philosophical topics; and his psychology—brilliant and penetrating though it be—is on the whole a new method of solving epistemological and ethical problems rather than a distinct science. This fact was of enormous importance for making psychology thoroughly respectable at the early date at which he wrote. With Ladd, psychology became a more definite branch of study and attained a certain body of content largely due to the Wundtian influence under which he wrote and to the specific task he set himself in the title of his text-book—the first of its kind in America and itself a signal service to psychology.[1] Nevertheless he returned, after making his psychological contributions, to the philosophical and theological fold "which he had loved long since, and lost awhile." Hall alone made on the other hand a distinct progressive departure from philosophy, which especially in its historical aspects had at one time a great appeal to him. Ultimately in his thinking it is philosophy which loses its kingdom at the hands of genetic psychology by falling

[1] *The Elements of Physiological Psychology*, 1887. *Cf.* preface to this first edition.

in line with all human manifestations as reflecting hidden goals or needs of the personality at particular stages of development.[2]

Stanley Hall was possessed of a vigor, curiosity and intolerance of restraint which made adjustment to the piety and complacent aridity of the New England of the sixties an impossibility. The obvious opening for the intellectually interested individual of his day—the ministry—became increasingly distasteful, and the first of his two triennia of study in Europe, with the deep draughts of the higher criticism then taken, led to a widening of the breach which completed his unfitness for a theological career, and which also sharpened his dissatisfaction with the New England educational situation.[3] His spirit of criticism of prevailing trends, his revolt, and his enthusiasm for European institutions aroused the distrust of the type of college president then common,[4] and so served as a handicap in most of the academic openings of the time. These very qualities, however, rendered him peculiarly adapted to such an institution as the newly founded and for psychology very happily timed

[2] *Cf.*, in *Founders of Modern Psychology*, 54 f., Hall's comments on Zeller's manner of discussing philosophers, which is the reason for the latter's being included among the "founders." "Sometimes it seems as if he (Zeller) were telling the shades of the old thinkers in the light of modern times what they really meant to say and how and why they came to the views they held. . . . . The tendency he started will not be complete until we regard the delineation of the ideas of Plato, Schopenhauer, and all between as what the Freudians call the patent content of an underlying vaster and more coherent latent content in which the higher psycho-analysis must find the original determinants of the systems which shaped and moulded and expressed opinions. Sometime the great systems and schools we now revere may be regarded as very much edited and refined types of folk-lore, partial satisfactions of so many kinds of instinctive wishes to believe, psychological documents of attitudes," etc. *Cf.* also 59, 73, 75, *etc. Cf.* further Why Kant is Passing, this JOURNAL, 23, 1912, 370-426. The ultimately suicidal nature of this method for genetic psychology—itself an expression of human personality—might be urged.

[3] *Life and Confessions of a Psychologist*, Chap. IV. *Cf.* 178, Hall's experiences at Union Theological Seminary. "After preaching our trial sermon before the institution we visited the president for criticisms. When I entered his study for this purpose, instead of discussing my sermon with me he at once knelt and prayed that I be shown the true light and saved from mortal errors of doctrine, and then excused me without a word." *Cf.* also 183, 219 ff.

[4] *Life and Confessions*, 196: "I thought I had a modest appointment in a large midwestern State university, but the president requested me by letter to tell him what I had done abroad, and on receiving my reply wrote me cancelling the engagement because he thought the history of philosophy which I wished to present in his institution would 'unsettle men and teach them to hold no opinions'."

Johns Hopkins University, whose first president, Dr. Daniel Coit Gilman, was suffused with ideals of scientific advancement rather than those of the prevailing propaganda. In 1882 came the opening at the Hopkins, with the opportunity to proceed with the work for which the publishing of the first edition of Wundt's *Grungzüge* in 1874 and Hall's second period in Germany spent largely in Leipzig with Wundt and Ludwig, the experimental physiologist, had developed an all-absorbing impulsion. This was the founding at the Hopkins in 1882 of the first psychological laboratory. No more timely or greater service to American psychology is conceivable than this of not only bringing to it the report of European methods and advances, but of transplanting bodily an energetic branch from the central growing trunk of world progress in extension of all phases of human knowledge. The story is a vivid one, and no complete complex feel of the growth of psychology in America is possible without reading in reflective and grateful mood Hall's memoirs and early papers on philosophy and psychology in America.[5]

Among the influences which led Hall to his activity in experimental psychology was the one which in James constituted the main determinant of his whole psychological contribution,—namely, the possibility it offered for the solution of problems which philosophy had pronounced insoluble or toward the solving of which no methods heretofore open to philosophy had brought satisfactory results. Other influences were, undoubtedly, his already apparent and growing conviction that the genetic approach, the evolutionary point of view, offered a new world of possibilities for explanation, and his passion for unifying, which together with technological interests was later to lead him to a "higher" reconciliation even with the Apostles' creed—a kind of "practical reason."[6] In 1878, in one of his earliest published articles,[7] he sounds an energetic warning against the employ-

[5] *Life and Confessions. Cf.* also Philosophy in the United States, *Mind*, 4, 1879, 89-105; The New Psychology, *Andover Review*, 1885, an introductory lecture delivered at the Hopkins, part of which also appeared in *Mind*, 10, 1885, 245-249; early papers in *The Nation*, from 1878 on, and the *North American Review* of the same period.

[6] *Life and Confessions*, 359, 422, 570.

[7] The Muscular Perception of Space, *Mind*, 3, 1878, 433-450.

ment in philosophy or elsewhere of such words as "unknowable." Sir William Hamilton and the "intuitive school" of philosophy had pronounced insoluble the problem of space perception. Hall, in the current of the stream of researches started largely by Johannes Müller and with his work in muscle-physiology in the laboratories of Ludwig and du Bois-Reymond[8] hard upon him, advanced the contrary view that the physiological and psychological study of the muscles and their sensations will yield the very basis of space perception and the key to its development. In developing this theme he assembles the results of many studies which in his mind point strongly to the existence of muscular sensation (at that date not fully established), and at the same time expresses the view that the discovery of the innervation-sense as the ulterior explanation of most or all facts of physiological psychology marks one of the most important epochs in the history of philosophy. The muscular sense is unique in that it alone does not show incommensurability between stimulus and sensation,—*i. e.*, actual motion of limbs arouses feeling (variously called by the author 'sense' and 'perception') of motion. Its essential character *as* motion is not changeable by any subjective or objective analysis; and so it follows that every sensation of motion is itself spatial. The muscle-sense is rudimentary in man; it is the first and most immediate of the senses. It enters into all experiences—is inexpugnable from all sensation—because of the constant flowing of nerve energy into the muscle, which thus responds to every variation in sensation; so the thinking self is one and indivisible in the whole organism, instead of the brain alone being the organ of mind. Nothing is spatial in intellect which was not first in sensation. The unknowable is that upon which the individual cannot react (here and elsewhere the article contains statements curiously suggestive of many tenets of modern "objective" psychology!). The burden of proof lies upon those who assert that, because space is the logical antecedent of motion, it is superimposed upon non-spatial sensation as an intelligible form of mind.

[8] *Life and Confessions*, 209. Ueber die Abhängigkeit der Reactionszeiten vom Ort des Reizes (with von Kries), and Die willkürliche Muskelaction (with Hugo Kronecker), *Arch. f. Anat. u. Physiol.* (His u. Braune), *Physiol. Abt., Supp. Bd.* 1879, 1-10 and 11-47.

Hall proceeds in a glowing vein to interpret and forecast. Soul-life begins in contractile tissue. The earliest sensation would be a vague area of nerve-muscle substance feeling its own motion as it moved. Here alone (though in a spatial respect only) "subject concurs with, is co-existent with, pervades object"—here the full solution of the space question lies. This primitive sensation-form is evanescent. Experience and elaboration make it a sign of external activity instead of a mere empty form of self-assertion. Psychical life, beginning in muscular substance, retires from muscle to nerve and from nerve-fibre to nerve-cell. Hall also suggests however that, since every property of nerve is now found in muscle tissue, sensibility in excentric portions does not demand complete neural circulation. Movement explains all things, but must itself be self-known. It is the element of space-perception *a priori* to perception of the special senses. Its nature enables experimental psychology to challenge the dogmatic dualism of the "scientific school" of metaphysicians.

The suggestive, stimulating quality of the writer is apparent, —the vistas of ideas whose attending excitement presses and over-rides questionable analogies and the demands for more minute and critical analysis and reservation of opinion which would give pause to a thinker of the more cautious type. This conviction of the strategic position of the cutaneous and muscular senses, their genetic and therefore explanatory significance, seems to have furnished a considerable share of the impetus to a number of the Hopkins studies which in turn have played a not inconsiderable rôle in later views in the field o space perception, especially in the discussion of the question o "local signs."

In his inaugural lecture at Baltimore[9] Hall further emphasized the importance in experimental psychology of work upon muscular action, of the extension of studies on the reflex, and of the rôle of tactual and visual sensations in throwing light upon the nature and laws of motion. Laboratory analysis of supposed indecomposable elements of mind—visual, tactual, auditory—have led to clearing and often to solution of philosophical themes. Moreover, Helmholtz' determination of the rate of the

[9] *Op. cit.*, Note 5, p. 3.

nerve-impulse, together with our knowledge of the elements in the "personal equation" (reaction time), enables us to make accurate measurement of the time and hence of the complexity and familiarity of many simpler mental processes, and to determine the effects on them of attention, toxic agents, fatigue, practice, etc.[10] The study of rhythm, periodicities of all kinds, will throw much light upon the consciousness of time, given in philosophy an exceedingly superficial treatment as a form of the sensory. Other promising fields, Hall thought, were being opened in the study of the brain, the determining of the situation of functional centers and the course of fibre-bundles; but he warned against the danger of forgetting, in a confirmed materialism, the utter incommensurability between the objective relations so determined and the closer, more intimate conscious processes. He emphasized also the importance of the study of abnormal states and individuals, and he described and discussed what he regarded as the essential personal qualifications for the student in this field in a fashion which has much of permanent interest and value.

Here was virgin territory indeed,—a wealth of vivid ideas, prospects, problems definite and more waiting to be definitized. With all of the loose ends, perilous slashings at Gordian knots, wavering terminology, what a feast nevertheless for the future

[10]Hall here voiced a current feeling of the great possibilities of the reaction-time experiment in various applications, the results from which however have been rather barren in contrast to the early hopes. Hall himself had already made a study of the effects of hypnotism upon the reaction time in an ingeniously conceived effort to throw light on the nature of the phenomenon of hypnotism, then a favorite subject for inquiry. He tested the reaction-time in the normal and the hypnotized states of a remarkable hypnotic subject then in town, arguing that, if hypnosis were an attention-phenomenon (a current view which Hall himself favored), then, since the reaction-time is reduced by strong concentration of attention, the subject should react much more rapidly when hypnotized than he was able to do in the normal state. Three hundred and twenty-nine reactions in three successive sittings (after which the subject had to leave the city) showed that the reactions in the hypnotized state were only about 57% as long as those in the normal state, although there was great variation and all reactions were abnormally slow for this subject. The author also made word-association experiments, and pointed out certain peculiarities in the reaction-words in the hypnotized state. Rather more than half of the article is devoted to interpretations and speculations, many of them suggestive and, as it proved, provocative of a lively discussion. (Reaction-time and Attention in the Hypnotic State, *Mind*, 8, 1883, 170–182. *Cf.* articles by E. Gurney in later numbers of *Mind*; also Hall's Recent Researches in Hypnotism, *Mind*, 6, 1881, 98-104.)

investigator![11] And the papers produced by the Hopkins group during the years immediately following showed serious and promising beginnings and definite contributions to a goodly number of the fields adumbrated. Hall seems frequently to have encouraged his students to include, in addition to their experimental findings and interpretation, suggestions of further vistas, possible significance of results, and the like. "Alas for the young investigator who does not show signs of thinking or intuiting beyond the data which his method or apparatus supplies, for laziness often hides under the guise of scientific reserve!"[12]

[11]This list fails to do justice to Hall's full versatility and to the omnivorous character of his genius even at this early date. He had previously published a paper on the perception of color in which he offered some experimental evidence which seemed to him to militate against the possibility of the existence of red-, green- and blue-sensing cones, and wound up with a suggestion of a mechanical color-theory based upon the supposition that the cones are composed of transverse discs of progressively varying diameter which vibrate sympathetically with the different wavelengths of light,—thus, the smaller ones of the tip yielding red. Mechanical agitation of neighboring plates gives after-images. This theory attracted some sympathetic notice at the time (*cf.* Grant Allen, *Mind*, 4, 1879, 267-268), but fell under Wundt's blanket condemnation of mechanical color theories (*Grundzüge*, 2, 1902, 429) and the later set against them. (See Color Perception, *Proc. Amer. Acad. of Arts and Sciences, N. S.* 5, 1878, 402-413.) Moreover, Hall had made a somewhat incomplete but very useful and suggestive study of Laura Bridgman (*Mind*, 4, 1879, 149-172), investigating her memory, imagery, dreams, use of sound and color words, and her cutaneous and muscular sensitivity. He found her to possess markedly increased tactile sensitivity. No evidence appeared for the existence of any dream content excepting tactual; the same thing was true of her imagery of memory and of imagination. He found decided emotionally expressive movements of her facial musculature, in which fact he saw an argument against Wundt's opinion that facial expression arises in movements calculated to modify vision, hearing, smell and taste. This study has been quoted frequently (*cf., e. g.*, Wundt, *op. cit.*, 2, 454. For a modern text, *cf.* C. Griffith, *General Introd. to Psychol.*, 1923, 258).

Several papers (including translations) on philosophy were at hand or already published (Outlines of Dr. J. A. Dorner's System of Theology, *Presbyterian Quarterly Rev.*, 1 and 2; Notes on Hegel and his Critics, *Jour. of Spec. Phil.*, 12, 1878, 93-103); the first of his list of books, which included several articles published elsewhere together with a series of impressions gathered in the course of his periods of study in Germany (*Aspects of German Culture*, 1881, pp. 320); papers on education and pedagogy (Chairs of Pedagogy in our Higher Institutions of Learning, *Bur. of Ed. Circulars of Inform. No.* 2, 1882, 35-44; The Education of the Will, *Amer. Inst. of Instruction*, 1882; also *Ped. Sem.*, 1892, 72-89; Educational Needs, *N. Amer. Rev.*, 136, 1883, 284-290); and the beginnings of the long line of articles on child-study, based on work done before the Hopkins period (Contents of Children's Minds, *Princeton Rev.*, 11, 1883; later in *Ped. Sem.*, 1, 1891, 139-173 and elsewhere; *The Study of Children*, 1883, pp. 13).

[12]*Life and Confessions*, 561.

Hall tells us that, although his title at the Hopkins was "Professor of Psychology and Pedagogy," his chief time and effort were focussed on psychology.[13] He also taught the history of philosophy, his goal being "to teach the whole field of the history of philosophy in such a way as to incline my students to a sympathetic attitude toward all philosophical systems and to make them in turn idealists, pantheists, materialists, associationists, and all the rest to the end that there be no indoctrination or effort at discipleship but that each should choose his own position intelligently and according to his own predisposition, an ideal which I freely expressed and which was never opposed." His students at the Hopkins were an unusually gifted group,—all able, most of them brilliant; and a very high proportion have since achieved eminence. Among them were Donaldson, his assistant in neurology, Jastrow, W. H. Burnham, Cattell, Edward Cowles, John Dewey, Hyslop, Noyes, G. T. W. Patrick, and Sanford. Of the thirty-odd books and papers which Hall lists as constituting the production of this group, himself included, during the years from 1883 to 1889, three were pedagogical, four philosophical, two in psychology of the abnormal, and at least fifteen (the great majority) in experimental psychology. Among the last-mentioned group were contributions to the fields of cutaneous sensation—including Donaldson's well-known work on the temperature senses,[14] in which he reports their punctiform character independently discovered at about the same time by Blix and by Goldscheider, and records the negatively resulting efforts to identify the sense-organs by examination of excised bits of punctiferous skin. Cattell's famous experiments on association and other reaction times were begun here,[15] and Sanford's, on reaction time and on the legibility of small letters.[16]

The published experimental papers of this period with which Hall's name is directly connected consisted in a series of four which were brought out in *Mind* and in the early numbers of

[13] *Life and Confessions*, 226 ff.

[14] On the Temperature Sense, *Mind*, 10, 1885, 399-416.

[15] The Time it Takes to See and Name Objects, *Mind*, 11, 1886, 63–65; The Time Taken up by Cerebral Operations, *ibid.*, 220, 377, 524; Experiments on the Association of Ideas, *ibid.*, 12, 1887, 68.

[16] Personal Equation, this JOURNAL, 2, 1889, 3, 271, 403; Relative Legibility of the Small Letters, *ibid.*, 1, 1888, 402-435.

this JOURNAL. Of these, the first to appear was one undertaken with E. M. Hartwell entitled "Bilateral Asymmetry of Function".[17] This was essentially an attack upon the "problem of the relation of right and left handedness to the more general law of bilateral symmetry" of function. Of the seventeen pages of the article ten are devoted to an introductory section in which are briefly stated an enormous number of previous observations or allegations regarding functional, anatomical and pathological asymmetries in the domains of sensation, motor reactions, the nervous system, embryonic development, and perception, winding up with views on the unity or duality of the soul. Exact references and often even the names of authors are absent, and the writers dismiss the whole collection with the statement that not all can be considered final. With a feeling of regret that this critical hint was not amplified into an evaluation of the data in terms of methods or related evidence the reader proceeds to the experimental section. The subjects were chiefly four young men, two right-handed and two left-handed, although control experiments were made upon "many people." None of the numerical results is given, not even averages or probable errors, an omission more excusable at that early date,—but instead the authors formulate conclusions "from tables too extensive to print." The experiments proper fall into five divisions; their methods and conclusions are as follows. (1) Subjectively equal diverging lateral movements of the two arms were measured by recording the distance traversed by the index finger-tips along the edge of a ruler, the subject being blindfolded. The preferred hand made the greater excursion, this rule holding more definitely with movements from the shoulder. The unilateral excess was less with slower or corrected movements, when vision was allowed, and when the movements were successive. Individual differences were marked and individual exceptions to main rules fairly common, one observer especially being divergent. (2) A vertical ruler was crossed with a horizontal one so that four quadrants were formed, and up-down movements were introduced with the primary position as a starting point, conditions otherwise being the same as in (1). The preferred hand still made the greater excursion, al-

[17] *Mind*, 9, 1884, 93-109.

though gravity, where it figured, was a more important factor and was never completely corrected by the subjects. (3) The writers tested their subjects' accuracy in bringing the two index fingers together in the median plane by means of symmetrical movements from the shoulders, eyes being closed, (*a*) at a point directly in front, (*b*) one directly over the head, and (*c*) one low behind the back. An ingenious arrangement employed by Bowditch was used,—two thimbles, the one tipped with a short projecting point and the other with a miniature target in plane transverse to the axis of the thimble, the two equalized in weight. The hits were found to cluster about a center often "rather" remote from the center of the target, which was fairly constant for one person but which bore no apparent relation to handedness. (4) A series of reaction experiments followed. The stimulus was auditory (a falling ball) and one set of reactions was made with the right hand to stimulation of the right ear, another with the converse conditions. The hearing of the two ears was found to be normal and equal in the case of every subject, and five reactions involving one side alternated with an equal number involving the other until many hundred had been secured. Three of the four observers gave slightly though constantly greater reaction-times with the preferred hand, but the fourth gave equally constant shorter times with this hand. The authors believe that the findings with the first three subjects, if they prove to be a rule, throw some doubt upon Wundt's identification of apperception with the generation of the motor impulse, which would lead us to expect shorter reactions on the preferred side. (5) Clenching power of the two hands was measured by a simple spring dynamometer. The preferred hand could always exert the more force. Eye-fixation (attention) on one hand always intensified its force, and work of one hand always reduced the simultaneous clenching power of the other. Tests of the ability to duplicate after two sec. a submaximal clenching movement indicated subsequent underestimation when one hand was employed in the duplicating effort, but the reverse when both were used.

The authors are convinced that their results indicate no need for assuming occult (soul) causes for departures from bilateral symmetry. The study of bilateral muscle-tensions, the only

acts of will, will reveal the key to a common principle for paired organs, and the solution of the problem now seems likely to shed light on the nature of consciousness. They regard their results as in the main tentative, and point out the need of more extended study. They make no attempt to correlate their findings with the lengthy series of observations mentioned in the first section.

The following year (1885) saw the appearance of the second paper, "Studies of Rhythm", by Hall and Jastrow.[18] A circular brass plate with notched edges in which projecting brass slots could be set at any desired intervals rotated past a projecting sharpened quill so that a snap was produced when a slot struck the point. By setting the slots in the proper notches a known tempo of snaps could be produced. The experiments began with a study of the accuracy of counting rapidly succeeding clicks varying in number from two to sixty-five, the intervals between clicks being .0895 and .0523 sec. Although the observers were highly certain of the accuracy of their count, nevertheless this invariably fell short of the correct number after four to eight snaps had sounded. This result the authors explain by the fact that the number of auditory impressions which can be distinguished in a second is much greater than the number of even the simplest movements which can be produced in the same time. They stress the complexity of the counting process. The second click is at hand before the reaction to the first is quite out of the way, the third click finds the second reaction still less complete, and so on, until a click comes early enough in the reaction to the previous one to be confused with the stimulus to that reaction. Further experiments were concerned with determining just observable differences in interval, with results which are suggestive only for the reasons that they lack adequate statistical treatment and that they are based on too few experiments. Finally, the authors undertook to determine whether the illusion of filled and unfilled space holds likewise for time, and the results were definite and positive for four observers.

A year later Hall and Donaldson brought out the results of an extensive series of investigations in a paper entitled "Motor

[18] *Mind*, 11, 1886, 55-62.

Sensations on the Skin."[19] The kinesimeter used by Donaldson,[20] with certain well-conceived accessories, provided a piece of apparatus by means of which a button or point could be brought in contact with the skin and moved over its surface at a uniform though variable rate, following skin-contours without variation in pressure. The weight and size of the contact-surface could be varied at will, and the direction of movement could be reversed. As to smoothness of control of stimulus thus secured the writers give us no quantitative evidence, and the mechanical principles employed by them are not above reproach.[21] They worked with up and down movements (toward and from the head), reserving study of transverse movements for a later paper. Seven tables of averages (without variations) present the findings, from which the following are the more important conclusions. (1) For all conditions of rate, weight and surface tested, the observers when in doubt judged the movement to be headward. Moreover, a weight too light to produce sensation when the movement was downward often did so when the direction was reversed. For this result the authors suggest a two-fold explanation,—man's greater familiarity with downward movements (rain, sweat, etc.) as compared with the likelihood of noticing upward movement as usually caused by living things, and the fact that upward movement is against the prevailing direction of the hairs. (2) An indeterminate sense of motion sometimes precedes any impression of direction. (3) Judgment of downward motion requires more time than does that of headward motion. (4) Where rate of movement is varied, the judgment is quicker with more rapid rates, but the actual distance covered is fairly constant. This distance is far smaller than the limen of dual impression for the same region of skin, and in the minds of the authors it indicates the existence of smaller motor "sensory circles" within Weber's discriminative circles. (5) When by a special apparatus observers were allowed to reproduce rate and distance with the other hand they

[19] *Mind*, 10, 1885, 557-572.

[20] *Op. cit.*, Note 14, p. 8. *Cf.* also E. B. Titchener, *Experimental Psychology, Instructor's Manual, Qualitative*, 94.

[21] The kinesimeter of Hall and Donaldson has been criticised in a searching manner and improved by E. W. Scripture and E. B. Titchener. *Cf.* this JOURNAL, 6, 1894, 425, and 7, 1895, 150.

estimated up-movements as longer than objectively equal down-movements. They overestimated relatively long movements and underestimated short ones. (6) With varied rate—the observers still reproducing the movement with the other hand—a given distance was reproduced as shorter when rapidly traversed, though great variation occurred. (7) Marked variation occurred in the sensitivity of different parts of the body. (8) Increasing the weight decreases the time needful for a judgment, and heavy weights seem to move faster than light ones going at the same rate, indicating in the authors' minds that a summation of extensive or qualitative data affects estimates of rate, and that if there be a simple motor sense in the skin it is not independent of aid from other sources.

(9) The authors then undertook a more intensive study of a small area of skin, eliminating variables by shaving and by mapping and avoiding temperature spots. The subjects still judged motion and direction within spaces far less than those needful for distinguishing two points, but warmth and especially cold spots were helpful in fixing locality and in judging motion. Shaving was followed, somewhat to the authors' surprise, by an increase in the difference between the times for 'up' and 'down' judgments. (10) Efforts to investigate further the phenomenon of sense of motion preceding that of direction yielded no results either quantitative or qualitative. (11) Investigations with an electrode as pressure-point indicated a great complexity and diversity of dermal sensations with uniform movement down the arm, and the rate of movement seemed to vary. (12) Experiments with extreme rates of motion indicated that with very slow motion (1 mm. in 10 to 18 sec.) a weight seemed at rest when it really moved 6 to 11 cm.; and, again, it was possible to produce extremely rapid motion of about three inches without the subjects' being able to tell at which end the motion began.

The writers conclude "that 'local signs' are quite heterogeneous, and that, in the strong tendency we have to move the touching dermal surface over objects in contact with it, we are seeking not merely to multiply but to diversify our sensuous data for judging the nature of the impressions and to fill up the dermal 'blind spots' between which impressions are sifted

in to us." Various facts indicate "the skin as not only the primeval and most reliable source of our knowledge of the external world, or the archaeological field of psychology but as a just opening experimental domain of great breadth, where work seems now possible that may compare in both quantity and quality with that accomplished in physiological optics, and which may shed new light on some of the most fundamental problems of psychical action and unfolding."

The next year saw the final one of the four studies, a paper by Hall and Motora entitled "Dermal Sensitiveness to Gradual Pressure Changes."[22] A weight travelling along a delicately balanced metal beam caused uniform variation in the pressure exerted at the peripheral ends of the beam. Of these, one bore a variable counterweight and the other a stimulus-button which rested on the area of skin employed, the tip of the left forefinger, which was held in a constant position and could thus be stimulated by any desired initial weight and rate of increment or decrement. The arm was kept at a constant height, to equalize blood-pressure, and the subject signalled when he became aware that the weight was increasing or decreasing.

The work consisted in one main series of experiments and three less extensive series undertaken with variations of the principal method. (1) Six tables of averages of twenty experiments each for six observers present the numerical results of the main experiment,—the authors stating that "as the experiments progressed the two chief causes of variation, viz., changing degrees of attention and of certainty, steadily diminished." Erroneous judgments were so rare as to be negligible. The first table shows the time in seconds of the judgments with uniform rate of increment and initial weights of 5, 10, 20, 30, 40, 50, 60, 65, 70, 75, 80, 85, 100, 200 and 500 gms. Five of the six observers gave slower judgments with the lighter and heavier initial weights. Of these, three showed fairly definite optimal initial weights of 70, 80, and 100 gms. respectively, while with the other two the time of judgment did not decrease in sufficiently progressive fashion to permit of a reliable inference as to optima. The sixth subject—a highly trained cabinet maker —showed far greater rapidity of judgment than did any other subject, judgments of the five-gm. weight being most rapid of

[22] This JOURNAL, 1, 1887, 72-98.

all. The second table shows the effect of varying the rate of increment, with an initial weight of fifty gms. chosen as a result of the above-mentioned findings. More or less regularly progressive increase in the time of judgment appeared with decrease in rate of increment.

Four following tables give the findings of the above two expressed in terms of gms. added or subtracted before difference was perceived (three and five) and the ratios of these numbers to the initial weights (four and six). The writers believe that their results indicate a relation very inaccurately approaching the constancy expressed by Weber's law,—a relation which is inexact, appears only within limits, and is subject to wide individual variations.

The results indicate far lesser sensibility to growing differences in pressure than to differences in weights successively applied. The writers discuss possible sources of error in the elasticity of the skin, change in area depressed as weight increases, and local anaemia with prolonged stimuli, but do not consider these as sufficient materially to affect sensitivity; it would require other methods to produce a change sufficient to crush or harm tissue without the subject being aware of it, after the analogy of frogs killed without struggle by increasing temperatures when the change is sufficiently gradual.

The writers go into the question of the nature of the conscious processes involved in the judgments which their method elicited. The observers did not experience continuity of change, either quantitative or qualitative, but instead attention singled out a degree of pressure and compared it with a remembered earlier degree. Decision was difficult and slow as compared with that present in successive weight estimation, because of lack of intervals for rest of terminal organs with consequent increase in their sensitivity, and because three instead of two factors must be held in mind, namely, initial pressure, possibility of increase, and possibility of decrease. Hence no inferences from the work of Weber and Fechner can be applied to the present experiment.

(2) In a second less extensive series of experiments the authors used initial weights of 1000, 500, 250, and 125 gms. These were increased or reduced by known amounts, and in some cases allowed to remain stationary. Three subjects gave fifteen

judgments each with increasing, decreasing, or unchanging stimuli and the corresponding three categories of judgment. A table of averages is given from which it appears to require much more time to perceive a stationary or a decreasing stimulus than an increasing one. Moreover, many errors of overestimation occurred, stationary stimuli being judged as increasing, and decreasing ones as stationary. This finding the authors explain in part by fatigue and expulsion of blood due to heaviness of weights.

(3) Sensitivity to negative pressures (pulls) was studied in the next two series. Adhesive plaster was fastened to the stimulus button, so that this stuck to the contact-finger. Ten pairs of alternate just detectable pressures and pulls were given and the results were averaged. The point of subjective neutrality or the apparent tactile zero—a point well marked for consciousness—was, curiously enough, somewhat more negative (on the pulling side) than the point of actual neutrality. The authors believe this to be a kind of mental compensation for the fact that in common tactile experience some pressure is practically always present. (4) In the final series, the apparatus was set at the apparent tactile zero and varied in a positive or negative direction until the observer recognized either pressure or pull. The sensations for a time proved to be surprisingly indistinguishable; for a moment the change might appear to be *plus*, then *minus*, in a fashion suggestive of binocular rivalry. After this latter analogy the authors called the phenomenon *antinomous dermal rivalry*, and explained it in part by pressures at the edges of the finger occasioned by the pull from the central portion.[23] Relative to the minimal stimuli required for tactile sensitivity, enormous weights had to be added or corresponding pulls exerted in order to elicit certain judgment. With slow rate of change, a much smaller degree of difference is correctly recognized. The region on the scale of pressure stimuli here concerned is one, the authors state, regarding whose effects practically nothing is known; it lies outside of the range of validity of the psychophysical law, and needs careful further investigation.

[23]A similar finding is reported in a recent paper. *Cf.* M. J. Zigler, An Experimental Study of the Perception of Stickiness, this JOURNAL, 34, 1923, 80.

In these four studies we have the experimental development which the field of cutaneous and muscular phenomena—so keenly interesting to him—received at the hands of Hall himself and his co-workers. The studies show great vigor and fertility of idea and resource. Ingenious apparatus was devised and adapted. Finished in some respects, in many they bear the stamp of the pioneer study. In them the literature was worked over for the striking and suggestive observation rather than for purposes of evaluation and orientation. They reveal striking trends, but methods employed were inadequate for the discovery of definite laws. They teem with hidden complexities and unexpected findings which await more complete description and determination of conditions. Further analysis has made highly probable the complex character of the consciousness of motion and other mental phenomena which Hall was inclined at the time to view as elementary. The studies in question did much to map out the field and to prepare it for the investigator with more intensive attack. They have attracted no little attention in connection with contemporary and later handling of the problems of tactual space perception, especially the discussions of the local sign, and the factors which affect the limen. Ladd among others presents in great detail the results of Hall and Donaldson relative to motor sensations on the skin, using them to support his view of the complex character of the local sign.[24] James mentions the same findings in the same connection.[25] Wundt refers in a footnote to Hall and Motora's findings as to the influence of rate of increment upon the difference limen for pressure.[26] What the subsequent history of the Hopkins laboratory would have been, had Hall continued his work there, we can only conjecture. In later courses on the feelings which he gave at Clark University he stressed the same fundamental driving idea that was influential in promoting the Hopkins studies,—namely, touch as the mother of, the genetic key to, all sensation and feeling; and he had at this time the unrealized hope of producing some day a large treatise on the feelings. Many things indicate, however, that the more methodical

[24] *Elements of Physiological Psychology*, 411; 1911 ed. with Woodworth, 404 ff.
[25] *Principles of Psychology*, 2, 1890, 155. *Cf.* also 281.
[26] *Grundzüge*, 1, 1902, 537.

studies would have been made by others. Hall's interest in child study and its application was well over the horizon. In a paper published in 1894[27] the "practical reason" and the pedagogical point of view are well under way; the method of teaching philosophy stressed at the Hopkins in somewhat diluted with a view to the need of immature minds; and regret is expressed that some of the (then) "new" psychologists go no further, but are content only to make methods more exact and results more refined.

But in addition to the laboratory and to the experimental contributions, one other outstanding service to psychology marks Hall's period at the Johns Hopkins University,—the founding in 1887 of this JOURNAL, concerning which Hall's own story is as follows.[28] "Toward the latter part of my stay here I had a memorable call one Sunday from J. Pearsall Smith of Philadelphia, an entire stranger to me who had learned something of the Hopkins work in psychology. He suggested that I found a journal and then and there gave me a check for five hundred dollars 'as a starter.' I had long desired to do this and President Gilman favored it, for the establishment of departmental journals was one of the prominent items in the program of the Johns Hopkins, so that at last, with great trepidation, I printed and circulated a prospectus, gathered material, and issued the first number, printing if I am not mistaken, the enormously excessive number of 3,000 copies and finding, when this number was distributed, that the bills for it alone footed up to seventeen hundred dollars. There were few subscribers and the deficit had to be made up from my own savings. . . . I may add that at one time it had cost me eight thousand dollars more than it had brought in, and although we were not able, after we entered the war, to publish the six hundred pages a year planned, it is now in its thirty-second volume (1921) and brings a modest profit—all without advertising itself or anything else. It was also very difficult to find good material. As the earlier volumes show, most of the small-type part of it, a half or more, which was devoted to reviews, was

[27] The New Psychology as a Basis of Education, *Forum*, 17, 1894, 710-720.

[28] *Life and Confessions*, 227 f.

written by myself. I read voraciously and epitomized over a wide field. . . . I sought to give the Journal wide scope, including the most salient tendencies in religious philosophy, logic, aesthetics, the significant work in the domain of psychiatry, child study, anthropology, etc." Pearsall Smith, whose chief interest was in psychical research, gave up even his subscription when the JOURNAL criticised this movement.

The experimental papers of the Johns Hopkins period mark Hall's last contributions to experimental psychology; after the long break in the stream of his psychological productivity occasioned by the founding of Clark University and the harassing administrative difficulties which absorbed his time he returned to quite a different type of psychological activity. The story of the early days of Clark University, the bright promise of opportunity for a second and even better Johns Hopkins which alone tempted him to leave his work, the long unhappy struggle owing to withholding of expected funds, the enforced reduction of departments, the reluctant compromises, constitute the material of a long chapter in the *Life and Confessions* and, we are told, the chief motive to its publication. During these years Hall managed to give many lectures dealing with educational topics and applications of psychology and to put out a stream of articles for the most part of similar character, but interspersed with an occasional historical essay and with numerous book reviews and notes. And most important of all, he succeeded in salvaging in addition to sufficient material means for limited university activity the all-important spiritual endowment of a university,—an atmosphere of entire freedom, a tradition of the supreme importance of contribution however small to the sum-total of human knowledge, and a variety of methods and points of view which provided untold intellectual stimulation through discussion and criticism. However much Hall grew in the direction of impatience with the slow and to him often insignificant progress of the laboratory worker, nevertheless the facilities for laboratory research never suffered at his hands, and the individual workers themselves often felt in Hall the administrator a pride in, and encouragement of, their work "patently" denied by Hall the geneticist.

During the early Clark period occurred the founding of the American Psychological Association. Hall, in conference with Ladd and others, planned a society of psychologists, and on July 8th, 1892, a group of more than twenty met at Clark University. The Association was formed as a result of this meeting, with Hall as the first president, and Jastrow as the secretary-treasurer. Three months before his death Hall was elected president for the second time,—the only individual with the exception of James to receive this honor.

In 1893 Hall resumed university teaching at Clark, Dr. E. C. Sanford having in the meantime taken over the laboratory. During the years immediately preceding, the tasks which he had undertaken had accentuated his interest in the needs of the student and in the function of the university and the school system. This practical interest and the interest in genetic psychology and child study—well established long before he left the Johns Hopkins—now assumed the dominant position in Hall's activity. The long series of questionary studies of the middle and later nineties resulted, and the outcome shows in the series of four volumes which Hall published during the years 1904 to 1911—the large two-volume *Adolescence*, the abridgement of this in *Youth*, the *Aspects of Child Life and Education*, and *Educational Problems*, the two-volume companion of *Adolescence*. Here are presented vast compendia embracing the great bulk of the findings, conclusions and beliefs of the whole civilized world on the subjects treated or those bearing on them, collected during many preceding years for university lectures. Generously incorporated are the yieldings of questionary studies which began to appear in 1895. Permeating the whole and furnishing the main source of whatever the books possess by way of organization and system is the author's conviction that the understanding of the present is possible only in the light of the whole evolutionary process, a conviction which led to, and was in turn reinforced by, a lecture course on animal and primitive human life, instincts and habits. Two articles constitute the only offshoots of this course in psychological literature,[29]

[29]A Glance at the Phyletic Background of Genetic Psychology, this JOURNAL, 19, 1908, 149-212; and What we Owe to the Tree-Life of our Ape-like Ancestors, *Ped. Sem.*, 23, 1916, 94-119.

for the reason that Hall regarded it as valuable principally in connection with pedagogy. "No course I have ever given sent so many of my students to the library or, I think, contributed quite so much to give them a general and wholesome conception of man's place in nature."[30] It began with views of the lifeless earth and theories of the origin of life in the world, and followed the progress of life from pre-protozoic forms up to historic times. All of Hall's later interests were definitely foreshadowed in the above activities.

Hall is most widely known as a psychologist, and it is thus that he commonly styles himself. Inasmuch as his other activities have to a great extent emanated from and depended upon the psychology of his mature years, it is this which demands the greatest emphasis in any consideration of his intellectual contribution. Closely associated with his psychology at every hand is his educational teaching. "The largest possible aspect of all the facts of life and mind is educational and the only complete history is the story of the influences that have advanced or retarded the development of man toward his completion. . . Thus psychology and the higher pedagogy are one and inseparable."[31] Owing to this peculiar connection which Hall makes between his psychology and its application, the temper of his work would be in a measure lost by attempting too separate a consideration of the two. What, then, is Hall's psychology, and how does it "work" in its most immediate applications?

In the introduction to *Adolescence*, which Hall tells us is essentially his first book, we are informed that the work is based upon the author's psychology, which should logically have been published first. The sections to which we are mainly referred for the psychology are entitled "Feelings and Psychic Evolution." Hall's projected work on sensation and feeling, which would probably have been the *Psychology* to which he referred, never appeared; so for the psychology of his mature and most productive period we must look chiefly to *Adolescence* and its—in large measure—companion and supplementary work, *Educational Problems*. For the rounding-out of his

[30] Cf. the description of this course in *Life and Confessions*, 363 ff.
[31] *Adolescence*, ix.

psychology and its educational and social bearings we must turn to *Senescence* (1922), which in a very real sense is a continuation of the trend established in the other two works. The object of the chapter which in the main presents this psychology is "to state in a brief and summary way . . . the general conceptions of the soul" that underlie his theme.

We find that Hall's psychology consists essentially in a basic law which constitutes the major premise of his whole thinking, a method of inference suggested by this law, and a body of facts accumulated from the literature and from questionary studies and interpreted in the light of this law.

The fundamental law, which Hall calls a "general psychonomic law", is an adaptation to the mental sphere of the concepts of biological evolution and the dependent doctrine of physical recapitulation, developed largely by Haeckel and Herbert Spencer. It assumes that the psychical life and its expressions in the individual develop from birth onward through a series of stages more or less closely corresponding to successive cycles of habits through which life and especially early man and his immediate ancestors are conceived to have passed. "As soon as I first heard it in my youth I think I must have been hypnotized by the word 'evolution', which was music to my ear and seemed to fit my mouth better than any other . . . . I think my curiosity somehow got an early tilt toward origins, and even in college (1863-1867) I brought much censure upon myself by advocating the view that man had sprung from ape-hood. . . For my German teacher, Trendelenburg, *Werden* or becoming was the prime category and the mother of all others, and this helped to predispose me to accept all I could understand of the Hegelian logic, in which all innate ideas evolve by an inner necessity from those that precede, by his three steps—thesis, antithesis, synthesis. . . Schelling's system ranked next because it treated all organic and even inorganic nature as steps in the unfoldment of a mighty process . . . Thus there was a kind of mystic, poetic stage of prelusion by which Darwin, Huxley, Spencer, Haeckel and even Tyndall were, it seemed to me, prepared for in my philosophic history, and when these loomed large upon my horizon they were devoured with the utmost avidity. . . . To conceive the whole world,

material and spiritual, as an organic unity, to eliminate all breaks and supernaturalism, and to realize that everything within and without was hoary with age, so that in most experiences we are dealing only with the topmost twigs of vast but deeply buried trees, gave me a totally new aspect of life. . . . I was bat-eyed to difficulties and impatient at objections, and had a blind spot in my mind for every break in the developmental order and implicit faith that if there anywhere seemed to be gaps it was only because we lacked adequate knowledge. . . . I was once introduced to an audience by an overzealous friend as the Darwin of the mind, and extravagant and absurd as I knew this to be, it gave me more inner satisfaction than any compliment ever paid me by the most perfervid friend."[32]

The above quotations explain much of the spirit with which Hall writes of his fundamental "general psychonomic law which assumes that we are influenced in our deeper more temperamental dispositions by the life-habits and codes of conduct of we know not what unnumbered hosts of ancestors, which like a cloud of witnesses are present throughout our lives, and that our souls are echo-chambers in which their whispers reverberate".[33] "Our soul is full in all its parts of faint hints, rudimentary specters flitting for an instant at some moment of our individual life and then gone forever, dim and scarcely audible murmurs of a great and prolonged life, hot, intense, richly dight with incident and detail that is no more; a slight automatism, perhaps, being the sole relic of the most central experiences of many generations, a fleeting fancy all that survives of ages of toil and blood, a feeling that only peeps out for a moment in infancy, the far-off dying echo of what was once the voice of a great multitude. Yet these psychophores, whatever they are, are wax to receive and marble to retain." They are "somehow represented in the lower . . brain levels, the sequence up the cord, medulla, basal ganglia, cerebellum being a better picture of the real evolution of mind when we can read its meaning aright than the chambered nautilus gives us of its stages of growth."[34]

[32] *Life and Confessions*, 357ff. Cf. also *Amer. Anthrop., N. S.* 6, 1904, 539.
[33] *Adolescence*, 2, 61.
[34] *Adolescence*, 2, 65.

The application in individuals of the "psychonomic law," far from being a simple and straightforward matter, is complicated by many circumstances. The chief of these consists in the vastness of the "collective soul," which is co-extensive with life. Much soul is lost; for whenever a species became extinct, a soul-type vanished. Every animal group may represent some one quality specialized and promoting the survival of that species. The human soul is one of many types. The conscious adult does not reflect the universe, but he is rather a fragment detached from the great world of soul, "well fitted to illustrate some aspects and hopelessly unable to exemplify or know other regions in the cosmos of soul. In him many different traits thus may contend for expression, this conflict being particularly likely to occur in offspring of different racial stocks. Layers successively acquired may be reversed in their appearance in the individual, while recent salient occurrences often appear to sink into fathomless oblivion, and very ancient tendencies may push up even into consciousness." Certain functions, notably sex, are variable up and down the scale. Large brain, acquired late in the phylum, is early in the individual. Thus the individual often distorts the racial order.[35]

According to Hall the normal growth of the individual mind necessitates the living-through of each stage, because the development of any one stage is the normal stimulus to the development of the succeeding stage. This principle is the guiding thread to his whole doctrine of education, although its application frequently has to be tempered in the interests of practical modern demands. Environmental factors, however, may cause the appearance of reactions before their normal time; this produces undesirable precocity. The result is the over-studious child, or the child otherwise prematurely habituated to adult ways. Perversions of certain kinds and accentuation of, *e. g.*, sex before the later rational processes which it should accompany may thus ensue. Moreover, certain normally earlier stages thus crowded out instead of being lived may emerge later as criminal tendencies, which are essentially misplaced reversions to lower savage strata.

[35] *Adolescence*, Chap. X., esp. 68. *Educational Problems*, I, 201f.

Such is Hall's fundamental law. In his mind it has certain bearings upon the present and future status of man. Despite elements of civilization that interfere with growth, "I am an optimist root and core, not merely because an evolutionist must hold that the best and not the worst will survive and prevail, but because in most though not yet in all of these fields I see clearly the beginnings of better things."[36] "Tentative as is now our knowledge, it is sufficient to generate a deep hope that man is yet in the making, that the best things have not yet happened in his history and that perhaps his present stage is at the same time the point of departure of a yet higher one related to all that adolescence now gives, as it is to the stages that preceded. Assuming the bionomic law, infant growth means being loaded with paleo-atavistic qualities in a manner more conformable to Weismannism, embryonic growth being yet purer, while the pubescent increment is relatively neo-atavistic. From this it would seem to follow that the more complete and established the maturity before offspring are produced, the greater the probability of phyletic progress in successive generations."[37]

Hall's central law immediately raises many problems, and suggests a programme. The child and the race are each a key to the other. "We shall never truly know ourselves till we know the mind of animals, and most especially those in our line of descent. We must recognize that some of them are our superiors in certain respects; that while we explain them by explication of those traits wherein we excel, they no whit less explain us by those of their traits which are superior to ours and of which our souls contain only relics; that if in general we are their realized entelechy, they are the key by which alone we can unlock many of the mysteries of our own origin and nature." "We must collect states of mind, sentiments, phenomena long since lapsed, psychic facts that appear faintly and perhaps but once in a lifetime, and that only in few and rare individuals, impulses that it may be never anywhere arise above the threshold, but manifest themselves only in automatisms, acts, behavior, things neglected, trivial and incidental, such as Darwin

[36] *Adolescence*, I, xviii.
[37] *Ibid.*, 50.

says are often most vital. We must go to school to the folk-soul, learn of criminals and defectives, animals, and in some sense go back to Aristotle in rebasing psychology on biology, and realize that we know the soul best when we can best write its history in the world, and that there are no finalities save formulae of development."[38] Consequently the method must be objective, carefully observational; and the "genetic" psychologist, while he must use introspection in the old way, or reinforced and perfected by experimental methods wherever they serve his purpose, will find it necessary, almost in exact proportion as his work becomes fundamental, to gather his data empirically from the comparative study of lower forms of life and of children and from the collation of many minds beside his own.[39] With this programme in mind, Hall chose the questionary method, supplementing the returns obtained by many students and by himself with the results of innumerable statistical and other studies and recorded observations obtained in the course of his amazingly extensive reading.

The results of these aims and methods in Hall's hands, together with their educational applications, compose the bulk of the four volumes of *Adolescence* and *Educational Problems*, and in a great measure of *Senescence* as well.[40] Hall never evolved more than the barest rudiments of a system of psychology in the ordinary sense; though he makes frequent use of general psychological concepts, he is at no great pains to define or to interrelate them, frequently indeed declaring definition impossible.[41] His impatience with classification was apparently a reaction from the to him hampering classifications of current philosophical or semi-philosophical systems. "The same revolution in the studies that deal with the soul impends that von Baer and Darwin represented for the body. Before their day, everything was classification, nomenclature, fixed species, just as with the pregenetic psychologists everything was faculties and processes, analyses and categories, as if the adult human mind as we know

[38] *Ibid.*, 2, 62; 1, vii f.

[39] *Ibid.*, 2, 62.

[40] *Adolescence*, 1904, 1373 pp.; *Educational Problems*, 1911, 1425 pp.; *Senescence: The Last Half of Life*, 1922, 518 pp.

[41] *Cf. Psychol. Bulletin*, 3, 1906, 53.

it were a fixed and settled thing."[42] Hall's psychology is a kind of nature study of childrens' minds and expressions, rather than a psychology in the scientific meaning of the term.

The terms "soul" and "mind" appear at times to have a slightly different connotation for Hall. "Most summarily, the idea of soul we hold to is in its lower stages indistinguishable from that of life, and so far in a sense we revert to Aristotle in holding that any truly scientific psychology must be first of all biological. Mind is almost, possibly quite, co-extensive with life, *at least animal life* "(italics not in text). A bit later, we have: "Mind and life are one and inseparable."[43] The terms are employed almost interchangeably, and if there is any difference it would seem to consist in a slight tendency to identify "mind" with the more plastic and adaptive ("intellectual") phenomena and "soul" with the more ancient, fixed life of instinct and feeling. We find a thoroughgoing dualism and interchangeable causality; Hall did not realize the monism adumbrated in his early paper on the Muscular Perception of Space (*cf.* Note 7, p. 3). The soul reflects the growth not of the brain alone, but of every part or organ. It is as profoundly sexed as the body.[44] There are as many types of mind as of body, and we can truly know soul only through body, and conversely. "A brain without mind is as impossible as a mind without brain, every normal and pathological change in either affecting the other."[45] In the light of the foregoing, the author's frequent references to "collective soul" and "mind continuous with life", related probably to his pantheistic leanings, are either figurative or purely mystical. Much the same thing is true of "man-soul," a term which appears with slightly increasing frequency through the series of his books and articles and goes through a kind of imperfectly progressive evolution

[42] *Adolescence*, 2, 62.

[43] *Ibid.*, 63. *Cf.* also *op. cit.*, Note 29, this JOURNAL, 200: "For one, I prefer to defy the current horror of anthropomorphism and to show a decent respect to continuity. Only to speculative and monoideistic minds can the question between some psychic rudiment and tropism be so put that we must cleave to the one and despise the other answer, for both are at the same time true and both are involved in the same reactions."

[44] *Adolescence*, 2, 57f.

[45] *Ibid.*, 63f. Hall became impatient with the controversy between parallelism and interactionism and dismisses it as fruitless in *Life and Confessions*, 431.

(analogous to the developing convictions of messiahship and son-ship which he elsewhere attributes to Jesus) from "man-soul" through "Man-soul" to "Mansoul."

Various divisions or processes of the "soul" or "mind" are designated and more or less clearly differentiated. Most stressed is that department which is composed of "feelings," "instincts," "feeling-instincts," "instinct-feelings," "sentiments." We are given little by way of distinction of these terms, —in fact, Hall has asserted vigorously that the feelings cannot be defined, and the best course with regard to them is to confess our ignorance (*op. cit.*, Note 41, p. 26). He regards the James-Lange theory as really only a philosophical speculation, entirely beyond the present reach of scientific investigation.[46] Hall is more interested in accounting for them, however. The feeling-instincts are "the deeper, older and more fixed unary or binary or at most ternary compounds that were matured and compacted before man arose." They are, *e. g.*, "the aggressiveness and cruelty of the carnivora, and the timidity and deceit of creatures long preyed upon." "Hunger, love, pride, and many other instinctive feelings, to say nothing of pleasure and pain, can be traced far down through the scale of vertebrate and to invertebrate life".[47] Belonging to this group are "the many-voiced comments, the sense of assent and dissent, . . . the illation of strength or the esthetic responses, the play of intuitions, the impulses to do or not to do, automatic tensions or contractions."[48] The feelings cannot be well remembered, or indeed they are entirely forgotten, because they are blind and inconsistent, lacking the intellectual factor of experience.[49] The feeling-instincts are assumed to be the psychophores or "bearers of mental heredity," some of which persist below the threshold of consciousness throughout our lives, while others "affect conduct as if striving to be relived and competing for the focus of attention or perhaps leading a submerged life in nearly faded automatisms."[50] These feeling-instincts may be "made over as instincts," or they may be "transformed into habits." The phrases are obscure, and the reader finds little to aid him in

[46] *Life and Confessions*, 430.
[47] *Adolescence*, 2, 60 f.
[48] *Ibid.*, 67. [49] *Ibid.*, 73, 91.
[50] *Ibid.*, 68.

an investigation of Hall's use of the term "instinct;" the word is employed in many connections, in a fashion literary rather than scientific, and even rarely in a manner which would seem to indicate that it does not imply heredity. Thus, in connection with childish fugues, he refers to "the instinct to follow a man or a vehicle. . When this truant instinct is strong *and hereditary*, as is often the case, . . the impulse . . may be irresistible and almost epileptic" (italics not in text).[51] Again, "such children often have a weak instinct for property." Young men may be dominated by "conservative or radical instincts."[52] "Subordination of each member to the whole and to a leader cultivates the social and co-operative instincts."[53] Of condemned juveniles, "472 lied from instinct and weakness."[54] An autobiographic instinct even is mentioned.[55]

In addition to the instinctive or feeling side of mind and soul, Hall has much to say about the conscious side, or consciousness, in spite of the calamitous possibilities which he thinks arise from the introduction of this term.[56] The occurrence of consciousness is favored by relatively quiescent intervals; it tends not to develop in periods of ferment and rapid change. Two main types of consciousness seem to exist for Hall,—a kind of surveillant consciousness or "enjoyment" of phenomena, and an adaptive consciousness, similar to that recognized by certain of the "functional" psychologists, *e. g.*, by Angell. The first type exists in a crude form in childhood. "The unconsciousness of the normal child makes it, though naked, not ashamed . . . Its consciousness is in this respect not unlike that of animals."[57] "The consciousness of childhood is molted, and a new, larger, better consciousness must be developed."[58] In the adult mind this type of consciousness is very limited, fragmentary, presentative of only the topmost twigs of the deeply buried tree of the soul or like a tiny flickering flame in a vast dark museum filled with the bones and fossils of ancient life. "Conscious life . . . in the best of us is pitifully unorganized and loose-jointed, and it differs per-

[51] *Adolescence*, 2, 376. [52] *Ibid.*, 87. [53] *Ibid.*, 2, 221. [54] *Ibid.*, 353. [55] *Life and Confessions*, 395.

[56] "Wherever the term consciousness is introduced there is confusion and no one ever yet accepted another's definition of this protean term." *Op. cit.*, Note 29, p. 20, this JOURNAL, 200.

[57] *Adolescence*, 2, 72. [58] *Ibid.*, 96.

haps most from the body in its fragmentary, incomplete and heterogeneous nature."[59] "The very self-consciousness that burns so intensely at some point, with attention often so obsessive, blinds us from seeing the larger rest of ourselves." "Highest, narrowest, most apical, and mobile as a tongue is the affective state of the present flitting moment, related to general personal mind as little as it is to the impersonal phyletic, or as it again to general soul."[60] Some intimation there is that consciousness might penetrate further, but how we are not told: "Each has, at least ideally, a capacity to comprehend much if not most of the experience of the race from the beginning, but this experience is dormant in us unless brought out by objective life or observation."[61]

The second type, the organizing and adaptive consciousness, arose late in the species and appears correspondingly late in the life of the individual. It appears to play a dual rôle. At times Hall views it as abnormal, a little disreputable. "We cannot believe that consciousness is even quite the efflorescence of the human plant. It may be a wart raised by the sting of sin, a product of alienation or a remedial process. . . . Consciousness seems in some of its aspects more likely a fall or a process of purgation so far as it is merely adaptive." "Our consciousness is but a single stage and one type of mind: a late, partial, and perhaps essentially abnormal and remedial outcrop of the great underlying life of man-soul."[62] Feeling may after all do the work of this consciousness: "Feeling may be de-specialization, dissolution, and preliminary to evolution along new lines";[63] and women and soldiers at least should have none of it. "She (woman) works by intuition and feeling . . . If she abandons her natural naïveté and takes up the burden of guiding and accounting for her life by consciousness, she is likely to lose more than she gains, according to the old saw that she who deliberates is lost."[64] "Conscience is the very acme of self-consciousness. It involves deliberation and excludes most of those energies of the soul that are *bewusstseinsunfähig* or which cannot get into the narrow field of consciousness. The case of

[59] *Ibid.*, 67.
[60] *Ibid.*, 66. [61] *Ibid.*, 65.
[62] *Ibid.*, 67; 1, vii. [63] *Ibid.*, 2, 67. [64] *Ibid.*, 562.

conscience must be submitted to an inner oracle, but the brief which consciousness submits can never contain all the data. Hence comes casuistry and every kind of perversion, *e. g.*, the conscientious objector."[65] But on the other hand the adaptive form of consciousness is an organizing and developing agent performing an exceedingly important function for the successful adjustment of the individual. If the larger, better consciousness is not developed, increased exposure and vulnerability will bring deterioration. "From the oldest trophic and vaso-motor functions and organs mediating pleasure and pain and perhaps other fundamental feeling-instincts, up the complex hierarchy of powers when the projection system itself slowly comes under some, perhaps tangential, organ of thought, and during adolescence when a suddenly widened area of life is governed and perhaps reconstructed by intelligence, this viaticum is easily and rapidly passed in normal psychogenesis, but for the full understanding of it the entire animal series . . . is none too large a basis. Conscious thought, noetics, intellect, reason, are popular and provisional terms for the last or neopsychic stages in this process, and all their higher forms are probably rarer and developed later in the average human being than is usually held."[66] Hall does not tell us what processes constitute the adaptive consciousness, but from such passages as the above and from the similarity of functions ascribed it is highly probable that these are the higher intellectual activities of reasoning and judgment, owing their character to the associative as opposed to the merely projicient apparatus. "In all this flux and chaos (jostling of barbaric and animal traits), however, common sense, that knows and adjusts to facts and to the external world, and the sciences of nature are the two solidest of all foundations and are represented by the solidest and most firmly woven brain texture; if man can ever bring order into the rest of his confused psychic life it must be by going back to these and working out and upward from them by observational methods in the inner as well as the outer world."[67] And it is precisely this function that is glorified in old age and constitutes its supreme ideal contribution.[68]

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[65] *Morale*, 3. [66] *Adolescence*, 2, 450.
[67] *Ibid.*, 69. [68] *Senescence*, Chap. 8.

Further efforts to work out Hall's criteria of mind and of consciousness and to line them up with various conceptions of the nature of consciousness—or perhaps any such efforts at all—are superfluous, so little was he concerned with matters of system. He makes occasional and more or less fleeting use of all or most of these conceptions. Neither did Hall have the slightest interest in working out a consistent envisagement and arrangement of the simpler and more complex processes of consciousness. He recognizes a kind of progression: "Sensation, perception and understanding represent roughly the various degrees of appropriation of apperception, the whole process of which is too integral to be partitioned."[69] The processes of childhood are those bound up with the projicient system,—the senses, activities, with rudimentary consciousness and practically no reasoning. Space and time are immediate realities bound up with touch and movement, and reality itself is an immediate datum of touch. Whether the senses in childhood belong to "intellect" or to feeling is uncertain, especially in the case of touch, under which Hall considers pain, a word which (after the older terminology) usually means for him the opposite of pleasure. Had he been interested in the issue, his reference of the senses back into a time far antedating the growth of consciousness in the adaptive sense at least might have led him to classify them as feelings, certainly as something not belonging to this consciousness. He does indeed—in common with other genetic writers—consider touch as a kind of primitive experience bearing the rudiments both of feeling and of the later "higher" senses. The organizing and synthetizing functions of intelligence are on the contrary late; and old age, if it realizes its complete destiny, elaborates these. Early and late adolescence and middle life are characterized by the progressive ordering of the riot of the feelings.

In the course of his writings Hall has much to say about imagination, and makes not infrequent references to ideational types,—"eye-mindedness," etc.,—which he thinks explain in a measure certain types of human activity. His attempts to assign imagination to a certain age and period are not completely successful, and its position with relation to the texture of pro-

[69] Why Kant is Passing, this JOURNAL, 23, 1912, 372.

cesses on the main line of development seems somewhat external. "Cloud forms have almost created the imagination."[70] "It is often a well-marked epoch when the young child first learns that it can imagine and state things that have no objective counterpart in its life, and there is often a weird intoxication when some absurd and monstrous statement is made, while the first sensation of a deliberate break with truth causes a real excitement which is often the birth pang of the imagination. More commonly this is seen in childish play, which owes a part of its charm to self-deception. Children make believe they are animals, doctors, ogres, play school, that they are dead, mimic all they see and hear. Idealizing temperaments sometimes prompt children of three or four to suddenly assert that they saw a pig with five ears, apples on a cherry tree, and other Munchausen wonders, which really means that they have had a mental combination independently of experience. Sometimes their fancy is almost visualization and develops into a kind of mythopeic faculty which spins clever yarns and suggests in a sense, ... that all their life is imagination."[71] "Puberty is the birthday of the imagination. This has its morning twilight in reverie, and if brilliant and vivid, supplements every limitation, makes the feeble athletic, the beggar rich, knows no limitations of time or place, and is, in a word, the totalizing faculty. In its world all wishes are actualized, and hundreds of our returns, elsewhere reported, show that in many sane children, their own surroundings not only shrivel but become dim and shadowy compared with the realm of fancy . . . The ingenuous youth sees visions or dreams somewhat according as he is ear- or eye-minded. The optical centers are especially sensitized to new harmonies of form and especially color. . . . Thought and the two higher senses are never so vivid and intense because they are just ready to bifurcate, each to lead its own life, so that the two are now peculiarly liable to be confused, intellectual processes to take sense forms, and *vice versa*. It is for this reason that hallucinations, false sight and especially hearing, is most common."[72] Hall relates sensory types (whether ideational or perceptual is not always clear) to philosophical *Anlagen:* "The eye-minded man is perhaps more disposed to

[70] *Adolescence*, 2, 69. [71] *Ibid.*, 1, 350. [72] *Ibid.*, 313f.

idealism than the practical motor-minded type. The blind have the most unfaltering sense of the reality of the external world because they are nearer the original tangible form in which reality was first given."[73] But apparently "thought" is something of more dignity than and of different stuff from imagination: school youth suffer because of over-stress of the concrete, with insufficient emphasis upon "the higher and more mental associations of likeness," relatively removed from activity, as opposed to "thinking", that is, "mere contiguity in space or sequence in time." "If their psychic operations can be called thought it is of that elementary and half animal kind that consists in imagery." "They lack even the elements of imagination which makes new combinations and is creative because they are dominated by mental pictures of the sensory".[74]

Turning now from Hall's fundamental psychological doctrines and "*apercus*" to a consideration of their results in his hands,—chiefly found in the bulk of the treatment of *Adolescence*, *Educational Problems* and in considerable measure in *Senescence*,—we note that in addition to statistical studies they consist for the most part in enumerations of what human beings at various ages—especially adolescence—are prone to think about, attend to, and react emotionally upon, and of what they attempt to do or actually do, and how much they feel and imagine and "think." Interspersed everywhere are "genetic" interpretations,—references to analogous phenomena in phylum and race,—and educational and other practical suggestions and considerations, which latter are often of great value, and which taken by and large constitute Hall's major contribution. Analysis or scientific description of mental process or reaction or emotion is rarely undertaken excepting in those instances where the object or goal of the reaction is obscure and hence a measure of specification of the reaction itself is necessary,—*e. g.*, in the case of reactions called "automatisms".[75] The net yieldings are

[73] *Ibid.*, 2, 46. [74] *Ibid.*, 2, 463.

[75] *Adolescence*, 1, 154ff. The treatment of automatisms here given—their progressive incorporation into voluntary systems—while not in all respects novel is vividly put and exceedingly suggestive, full of valuable hints for the teacher, clinical psychologist and psychiatrist. *Cf.* also A Synthetic Genetic Study of Fear, this JOURNAL, 25, 1914, 149-200 and 321-392, for examples of the author's more complete descriptions of emotions.

essentially an envisagement of certain demarcated stages in the growth, both mental and physical, of the human organism, with a vast accumulation of questionary and statistical data regarding each stage; of the growth-stages of certain parts of the organism; of certain modifications of growth due to sex, and of the results of asymmetrical or impeded growth.

Growth is the subject of the first three chapters of *Adolescence*,—growth in height and weight, of parts and organs, and of motor power and functions. The bulk of these longish chapters is devoted to assembling the results of numerous studies of the rate of growth from embryonic to mature stages, and to inquiries into the factors which influence growth, to canvassing of opinions relative to the existence of optimal rates of growth, and many similar questions. The immense labor of gathering this material, and the intimations of the possible practical significance of its various phases, make the preparing of the book an outstanding service to the practical worker and to the investigator in the fields of human adjustment and maladjustment. The prepubescent retardation, with the subsequent pubescent outburst in which girls precede—revealed in all the studies—is of great interest to Hall; he regards it[76] as a relic of pre-savage and savage epochs, in the first of which the female was forced to assume maternal functions before "nature had completed her preparation" for them, with resultant slowing of growth, while in the later period taboos arose which postponed impregnation and so favored growth activity. Or natural selection may have played a part; since female coyness and reserve develop before full sexual desire, the largest and most vigorous girls would succeed in resisting impregnation and would later produce maturer offspring.

From the numerous phenomena of disproportionate growth of parts Hall draws the following conclusion: "If the soul grows with every part of the body, its development is not continuous, uniform or proportionate, but with successive nodes, the earlier stages ever a little more strange and alien to the newer, like dimly remembered past lives to a transmigrationist."[77]

[76]How seriously Hall took any one of his "genetic" explanations is a problematic matter; he remarks, "I have constantly suggested genetic explanations of all degrees of probability" (*Adolescence*, viii).

[77]*Adolescence*, I, 128.

The theme of the muscles and their functional growth is an inspiring one to Hall. Muscles are the organs of will, thought and feeling, the media of accomplishment of all human edifice and of character. The development of the muscles in both race and individual according to Hall progresses from that of the larger, fundamental muscles to the finer, accessory ones "that wag the tongue and fingers." This is one of Hall's most insisted-upon precepts for pedagogy; in his education, the child should be encouraged in his impulses to develop his larger muscles before he begins exercising the finer ones. Current tendencies to force him to school before eight years of age are dangerous for the reason that premature exercise of accessory muscles tends to develop precocity, miniature adulthood, with all its attendant risk of a later appearance of "savage" tendencies thus crowded out at their normal time of appearance. Muscular development is closely correlated with sexual maturing and Hall finds much to convince him that this in boys is the result of fighting for desired members of the opposite sex, which latter has been and is a principal cause of conflict. The treatment of "motor automatisms"—by which is meant the total of "unconscious" movements such as swayings, tappings, fingering of objects; in short the total of movements sometimes referred to as random—has many elements of practical insight and valuable suggestion, however one may regard the genetic interpretations offered. These movements present survivals of old adjustments worked out by remote ancestors, and their display constitutes a necessary and proper stage preliminary to the development of higher powers. Perhaps they should even be encouraged, if we knew just when, by stimulating reflexes and so promoting "low-level connection between afferent and efferent processes that brings the organism into relation with the world of sense." The age of control with inhibition follows: the child must learn to sit still, a difficult task. But almost immediately Hall recalls the more modern conception of inhibition as a long-circuiting of processes and a directing of energy elsewhere, and the "psychonomic law" is for a time in abeyance while the author makes many observations of insight and suggestiveness especially in the matter of present social conditions which impede desirable growth-processes. The automatisms

are the raw material of intellect, feeling and will, and education should so guide events that none is left to expend its strength outside of the domain of voluntary control, integrated habit-patterns. Thus integrated, the fullest strength is available,—witness the superiority of the brain-worker to the manual laborer in tests with the dynamometer because of the former's ability to turn into one outlet energy generated over a larger surface.

But the integrating process may be arrested. Automatisms are similar to ideas, which tend to grow to delusional "intensity" unless checked by others; thus movement may "pass to fixed attitudes and postures of limbs and body, disturbing the normal balance of flexors and extensors." "They are motor analogues of the stray, segregated psychoses that make the subconscious activities now beginning to be studied".[78] Children of twelve who sway, can't sit still, possess these automatisms in most marked form and are often the constitutionally duller ones. The chief of the avoidable causes of such anarchical movements is overpressure, misfit between environment and nature. To avoid this, safeguards are needed superior to gymnastics; and the sad inadequacy of the many "schemelets" extant is shown by the puny bodies and nervous youths so commonly seen at the present day. Hall discusses the inadequacy of the modern industrial city with its passive amusements or at best activities under unhealthy conditions as a substitute for the older supremely educative home life—especially on the farm—in a manner the reading of which could not but be beneficial to any individual who attempts to work with youth in the city, and which has already exerted a marked influence. As to remedial measures: the farm is the best educator. Industrial education is beneficial in proportion as other phases (scientific, historical) are emphasized in addition to the mere acquiring of skill. Sloyd tends to the grave educational error of overstress on method and loss of content and goal and individuality of emphasis. Many forms of outlet overstress back and shoulder and arm muscles at the expense of leg muscles. Studies showing the sporadic growth of skills indicate the need of wider knowledge of characteristic "plateau" periods with stress on sense or perceptual training which will encourage subsequent motor spurts.

[78] *Ibid.*, 160.

The psychology and pedagogy of play follow, in the discussion of which, after the recapitulatory interpretation, occur many points illuminating to the individual who would increase motivation and zest in childrens' activities, the main difference between play and work lying in strength of motivation. "The heart of youth goes out to play, as if man remembered a paradise." "Interest and play are one and inseparable as body and soul. Duty itself is not adequately conceived and felt if it is not pleasure, and it is generally too feeble and fitful in the young to awaken much energy or duration of action. . . Work is menial, cheerless, grinding, regular, and requires more precision and accuracy and, because attended with less ease and pleasure and economy of movement, is more liable to produce erratic habits. The worst product of striving to do things with defective psychic impulsion is fatigue in its common forms, which slows down the pace, multiplies errors and inaccuracies, and develops slovenly habits, ennui, flitting will spectres, velleities and caprices and neurasthenic symptoms generally. . . Instill into a boy's soul learning which he sees and feels not to have the slightest worth and which cannot become a part of his active life and increase it, and his freshness, spontaneity, and the fountains of play slowly run dry in him, and his youth fades to early desiccation."[79]

Following the cues suggested by asymmetries and blockages of growth at lower levels, Hall takes up in two succeeding chapters the problems of diseases of body and mind, and juvenile faults, immoralities, and crimes. His thesis is that, in the light of the evidence that ontogeny often reverses or fails to follow phylogeny, we have at adolescence a period of great temporary plasticity, a loosening of the bonds that hold developing parts into a more or less unitary whole, and a struggling among ancestral elements which are compactly knitted together in proportion to the time of their association in the phylum. The bulk of the text is devoted to the assembling of studies upon the incidence at adolescence of various diseases and insanities, the effects of school upon health, and the like. Mental peculiarities of adolescence receive much space, and for these Hall draws heavily upon his questionary returns, finding many perversions

[79] *Ibid.*, 233 ff.

of appetite, irregularities of sleep, intensification of dream life and fancy, over-meticulousness, consciousness of self and over-assertion of individuality with silliness largely due to fear of ridicule in connection with developing fancies and sentiments, marked tendencies to imitate due to the very uncertainty and turmoil and furnishing a basis for the "social instinct," dramatic trends, loquacity and also shyness. All youth is for a short time at least genius, and genius is the apotheosis of adolescence in gifted individuals. "Excess of normal vitality not only safely can but must explore the beginnings of many morbidities, both to know the more varied and intense possibilities of human life and to evoke the sanifying correctives."[80] Sex functions appear first as irradiating activity and later as localized sensations, not as yet associated with the opposite sex, before the brain reacts on the sex organs and control is established. Along with these manifold tendencies the cerebral controlling mechanisms (judgment and "common sense") are developing and normal personality results in proportion as these show their influence. Any factors that make for precocity—springing up of sex and other instincts before normal control processes can assert themselves—are favorable for the development of morbidity and mental aberration, and to the formation of a blasé outlook, with deadening of admiration and enthusiasm. Hall thinks that previous bad pedagogy and many conditions incidental to city life and civilization with its prolonging of the period of apprenticeship are among the leading causes of such arrest. He suggests also the rôle of race mixture.

Youthful offences are indications of the difficulty experienced by youth in adjusting itself to social conditions. Normal children manifest at various stages of their development all the main "savage" and atavistic tendencies which, if disproportionately developed or not checked by tendencies which normally appear later, and if made more consequential by adult bodies, constitute the criminal picture. Criminals are essentially overgrown children. Hall is inclined to accept the view that children who offend are as a rule smaller and to a relatively great extent characterized by asymmetries together with others of the so-called "stigmata of degeneracy" of the Italian school; in his

[80] *Ibid.*, 321.

opinion, biological considerations would favor the view that physical asymmetry is prone to accompany exceptional character and conduct. Decadent stocks and retrograding functions are frequent biological phenomena. Among the causes of "crime" in juveniles, then, we must reckon the existence of an "innately criminal" mind, a "degenerate" in whose case perhaps the "animal part of his nature is abnormally and congenitally disproportionate to the intellectual," and who is sure to be an easy victim of the influence of the seasoned criminal with his "society-owes-me-a-living" code. Poor intelligence, which checks the development of the controlling process, is another cause, and a discussion of tests of intelligence occurs in *Educational Problems*.[81] Many environmental causes are discussed,—poverty and degradation in the home, hunger, weather, school, restriction, inadequate training. "There is a pregnant truth in the saying that every society has just the kind and number of criminals that it deserves." "One thing is certain, that the great body of crime is not to be essentially reduced by criminal codes, however skilfully drawn, but only by bettering the individual and social conditions of the community at large."[82] The remedies are, first, understanding, living with the "criminal" youths. "Those smitten with the institution craze or with any extreme correctionalist views will never solve the problem of criminal youths." Those who deal with such youths "should be educators with souls full of fatherhood and motherhood, and they should understand that the darkest criminal propensities are frequently offset by the best qualities, that in the criminal constitution there are precisely the same ingredients, although perhaps differently compounded, . . as in themselves."[83] Flogging and scolding have advantages, if used judiciously. Reading of exciting adventure stories in tender years may serve as a catharsis in the Aristotelian sense, "to arouse betimes the higher faculties which develop later, and whose function it is to deplete the bad centers and suppress or inhibit their activity." Boxing furnishes both vent for and encouragement to control of the anger impulse. Improving the efficiency of the schools as agents in moral training by utilization of the sentiment of

[81] Vol. 2, Chap. XI. *Cf.* also Chap. XII.
[82] *Adolescence*, 1, 341f. [83] *Ibid.*, 407f.

justice is important; pain must follow and measure the offence by natural methods, and there must be no personal unmotivated clemency.

The handling of sexual development and periodicity and of adolescent love includes the usual discussions of the vast biological rôle of sex and love, and a massing of data on physiology and growth of sex organs, effects of castration, studies and opinions regarding nutritive and other accompaniments of periodicity in women. The assumed effects upon the soul of the organic basis of sex, especially in women, prompt discussions of attitudes and psychical phenomena related to sex whose existence in any save a few abnormal women is very problematical, and suggests a regime of periodic rest and retiring to meditations upon the vast racial trust which is hers that the author, in a less strained mood, would probably condemn as admirably calculated to produce the sympathy-craving, symptom-mongering neurotic invalid whose appearance he elswhere deplores. Part of the description of adolescent calf-love is exceedingly striking and judicious, both in *Adolescence* and in the chapter on the budding girl in *Educational Problems*, although its character is essentially literary rather than scientific. Long chapters on the adolescent quickening to nature and on the phenomena of religious conversion are included, with pedagogical suggestions. The importance of a broad religious training in guiding adolescent feelings, especially love, to a love of righteousness, of humanity and of the universe is stressed; this is the most powerful means of steering in safety through the storm and stress period. There is no domain of education, from kindergarten to university, from trades to classics, and no type of institution or provision for atypicals, but receives consideration and pedagogical suggestions.

In the course of the writings under consideration, Hall works out more or less detailed descriptions of at least five stages of life, with suggestions regarding the racial period which formed the stage and with outlining of the type of pedagogy desirable for each one. The period of infancy and early childhood harks back to remote animal ancestors. The child should be much left to nature, the parents and teachers following the promptings of love; sand, large blocks, abundant opportunities

to exercise the larger muscles are the order of the day. A second unique period in human life is the age from eight to twelve. The brain is nearly adult in size and weight, health is almost at its best, activity is greater and more varied than at any other time, there is peculiar endurance and resistance to fatigue. "The child develops a life of his own outside the home circle, and its natural interests are never so independent of adult influence. Perception is very acute. . . . . Reason, true morality, religion, sympathy, love and esthetic enjoyment are but very slightly developed. Everything in short suggests the culmination of one stage of life as if it thus represented what was once, for a very protracted and relatively stationary period, the age of maturity in some remote, perhaps pigmoid stage, . . when in a warm climate the young of our species once shifted for themselves. Heredity is more stable . . . the elements of personality are few but are well organized and on a simple effective plan." At eight years, Hall reluctantly concedes, the child must start school and precociously work the smaller muscles, for he is a candidate for a highly developed humanity. The insight necessary to give response to school tasks is not present, the wisest requirements seem alien, but the senses are alert and reactions are vigorous. Consequently this is the age for drill, breaking the child into basic habits of all sorts with the least amount of explanation or coquetting for natural interest. The method should be authoritative, dogmatic. Duty and the spirit of obedience must be instilled.

The adolescent, next, is neo-atavistic. Development is more saltatory, suggestive of some ancient period of storm and stress when old moorings were broken and a higher level was attained. There are increased morbidity and diminished morality, reconstructions of the functions of every sense, progressive assertion of sex, lust to know nature, and many other changes including those heretofore mentioned.[84] Then comes later adolescence, about the nineteenth year, marked in boys by a practical cessation of growth, by some decline in the curve of health, and by "other phenomena that suggest that, having achieved adult size, there is likely to be a period of slightly reduced vigor as if to rest and adjust after being cast up by a

[84] *Adolescence*, Preface.

flood-tide on the shore of manhood a little exhausted. . . . At this point perhaps the individual represents the phyletic stage where, in its survival value in the struggle for existence, the advantages of increased size and strength began to be surpassed by those of a higher mentality and the main current of evolution swerved thought-ward." Loosened cohesions are being re-compacted. To fit this age, the college should stand for extensive rather than intensive study.[85]

Then follow the stages of maturity, the "youth of old age," and senescence, where the feelings, although often vivid, are suppressed and the intellectual functions and the wisdom which only age can bring are in their glory. If the race is ever to achieve its goal, "ripe and normal old age" must "gather the fruitage of the past" and "penetrate further into the future."[86]

The above is far from being a complete presentation of the many trends and varied phenomena which Hall attributes to adolescence and to other ages, and of his numerous discussions regarding the value of dancing, music, art, and other branches in meeting the needs of the different stages of development. The writer believes, however, that it is typical. From the psychology which Hall developed mainly in *Adolescence* his later-culminating interests in Freudianism and in religious psychology emanated. Hall's stress upon feeling and his centralizing of the phenomena of adolescence about sexual development and the associated evolution of love made him an eager student of the Freudian views. He never fully accepted the Freudian doctrines of the all-dominance of sex, for he regarded hunger as its co-partner in directing the struggles of the phylum and hence of the individual, and even made hunger the subject of a course of lectures in which he traced the influence of appetite and the factor of nutrition in shaping the feelings, instincts, habits and mind in general. He also outlined a scheme for applying the Freudian mechanisms to anger.[87] In spite of these and other reservations, however, his enthusiasm for Freudianism grew and found its most conspicuous expressions in his zeal for introduc-

[85] *Ibid.*, 2, 527 f.

[86] *Senescence*, esp. Chap. 8.

[87] Anger as a Primary Emotion, and the Application of Freudian Mechanisms to its Phenomena, this JOURNAL, 26, 1915, 438-443.

ing it to America *via* his students and his reviews of literature, and in his bringing to America in 1909 of Freud himself and his then leading European and American disciples.

From his early concern with theology and philosophy Hall carried a deep-seated interest in the psychology of religion—in religion explained as a need and construct of the soul, divorced of any supernaturalism, and (as his interest in youth grew) adapted to the requirements of the ephebic mind as he conceived it. Much of the chapter on Conversion in *Adolescence* is devoted to developing a "human" Jesus and a religion which should create in youth a feeling of unity with humanity and the universe and should guide the developing capacities of love in these directions and so constitute a supreme socializing influence. Trends emanating from this felt need, brought to a focus by the biographical methods of the psychoanalysts, led to the writing of the two-volume *Jesus the Christ in the Light of Psychology*, which appeared in 1917 and is in some respects the best of Hall's works because his methods were best fitted to this type of task. Here he traced extensively religious doctrines and cults current at the time, and developed the thesis that the Christian faith could be explained as a project of the folk and individual soul, or that, if Jesus were an historical character, the ideas of messianity and of son-ship to God could have developed in him as a result of influences extant in his day. The somewhat Hegelian interpretation of the death and resurrection *motif* as a kind of summation of life is much stressed by Hall, who finds it pervading initiation ceremonies, myths, history, and even the evolutionary processes themselves.

In addition to his many books and articles, almost four-hundred in number, Hall's activities during the Clark period included the founding of three additional journals, two of which are still in existence. In 1891 he started, at his own expense, the *Pedagogical Seminary*, a large part of the contents of which in the early volumes came from himself and from Clark colleagues and students. The *American Journal of Religious Psychology and Education* he started with the aid of the University in 1904; at the fifth volume the name was shortened to the *Journal of Religious Psychology*, and the editing passed largely

into the hands of Dr. A. F. Chamberlain, with whose death in 1914 its publication ceased. In 1917, Hall and Dr. L. R. Geissler started the *Journal of Applied Psychology*.

In viewing Hall's work as a whole, many internal contradictions stand out, perhaps because it is in a state of rapid and tumultuous growth and inner incompatible enthusiasms not unlike the adolescent whom Hall describes.[88] These very inner incompatibilities serve to sharpen pedagogical problems and hence have a value to education which is not inconsiderable. Of these conflicting trends, the most marked is the opposition between the order of nature demanded by bionomic and psychonomic laws, on the one hand, and the regimen and control demanded by practical situations, on the other,—a duality which is not without reminders of Kant's distinction between the pure and the practical reason. The "surge and thunder" of the genetic currents lead Hall into positions which he rejects when the set is otherwise, because he is also an observer of insight and possessed of much of the "common sense" which he evaluates so highly at times; despite his antipathy to explaining by the nearest cause,[89] he is not unmindful of it in practical connections. The difficulty appears in the need for the eight-year-old to enter school and run the risk of "precocity" by developing accessory muscles. If the principle of the dangers of a later outcrop of "savage" tendencies and of the basis for a criminal career thus afforded holds, should we not rather re-make the whole system on the order-of-nature basis than take such chances with childhood? Again, the authoritative regimen and stress on duty, obedience, and drill indicated by the nonrational character of the child provide what we later read is the best possible basis for truancy, development of automatisms and lack of volitional concentration; and, moreover, it fails to utilize the zest of the play-tendencies. As Winch pointed out,[90] there is truth on both sides, and later pedagogical resources and "model" schools have gone far toward combining the advantages of the two. The disparity between the need of concreteness and the need of more abstract language symbols is in similar

[88]Cf. review of *Adolescence* by E. L. Thorndike, *Educ. Rev.*, 28, 1904, 217-227.

[89]*Op. cit.*, Note 29, p. 20, this JOURNAL, 181.

[90]W. H. Winch, review of *Adolescence* in *Mind*, N. S. 14, 1905, 259-264.

case. Again, the difficulty appears in the uncertain rôle assigned to the "higher" consciousness, the organizing and adjusting mental functions; composing in the "genetic" key Hall makes these somewhat abortive and conducive to casuistry, but when the key shifts to the practical, they are glorified into "common sense," the greatest hope of youth and the basis of the supreme contribution of age. The regime which the ideal woman should follow in the light of the genetic law would exclude her entirely from the consolations of senecsence. That which alone can save erring youth spells doom to morale in the soldier. If the "genetic" law holds and feelings are the fundamentally reliable guide (*Morale*), why the disadvantage of mental defect? and so forth. The question has important bearings for ethics, but is confusing to the main issues and out of place in psychology, whose problems are quite otherwise. Hall encounters difficulties similarly conditioned in his teaching relative to the fate of stages of development which have been passed or skipped in the individual. If the complete realization of one stage, in so far as possible, is the essential condition to the stimulation of the next, how is precocity possible? And if a stage is crowded out by circumstances, how can it break out later in the absence of its requisite stimulus? Hall takes refuge in the reversions of stages and the jostling of diverse traits, and in the view that environmental suggestion is equally capable of evoking a stage; so many concessions are made, however, that one suspects the significance if not the fact of any "order of nature." Difficulties incidental to practical needs for repressing "animal" and "savage" stages have frequently been indicated by Hall's critics.

Hall's unqualified acceptance of the doctrine of the inheritance of acquired characteristics leads him to the view that the acquisitions of the individual cannot be transmitted and so accrue to the race unless maturity is reached before reproduction, a position which bodes ill for the race ever acquiring the later valuable maturity of old age unless we draw heavily on the principle of the variability of sex on the age scale.

Another "internal" difficulty appears in the inability to establish stages in the individual of sufficient definiteness to warrant the phylogenetic explanation. Both the paleo-atavistic child and the neo-atavistic adolescent have "births" or "golden

ages" of sense, of perception, of imagination. Both require exercise of fundamental muscles. The descriptions of the crudities of behavior—especially that concerned in interest in the opposite sex—of the child and the adolescent have much in common.

Many difficulties of an external character may be urged against Hall's psychology,—difficulties of method and of fact. Hot-footed in his quest for data to fill out the gaps in the known evolutionary process and indifferent to other problems, he was too impatient to use the slow and to him insufferably tedious methods of the laboratory. In 1904 he expressed regret that some of the "new psychologists" (which at that date meant experimental psychologists) go no further, being content only to make methods more exact and results more refined.[91] "Scientific psychology was becoming more and more prone to flout the good old Aristotelian dictum to the effect that it was only affectation to treat any subject by more exact methods than the subject matter demanded. Hence I felt that laboratory psychology had been influenced too much by the exact physical sciences and not enough by biology." "Introspection made no attempt to explain the flitting vestigial and marginal states" that its devotees "recorded, or to trace the differences in these phenomena to their origin in individual disposition or experience, and drew few and meagre conclusions from the vast body of data which they accumulated."[92] In addition to such complaint, Hall's objection to the introspective technique at least was based on his view of the limitations of consciousness, that it must perforce be useless in proportion as work becomes fundamental,—although he takes it more seriously in his attack

[91]The New Psychology as a Basis of Education, *Forum*, 17, 1894, 710-720.

[92]*Life and Confessions*, 361, 433. At the time of the first intense interest in the higher thought processes as attacked in the laboratory, shortly after the publication of Titchener's *Experimental Psychology of the Thought Processes*, one of Hall's students incorporated the concepts of the *Aufgabe*, the *Einstellung* and the *determinierende Tendenz* in his thesis. A stormy time followed; but Hall's lectures soon began to teem with references to the laboratory work on the higher mental processes, and he called at the quarters of certain of the laboratory students with the request that they review their data with him very carefully. His hope that the laboratory had its hands on the tail of an ancient lead—if such hopes he had—were apparently disappointed, however, for in *Life and Confessions* (361) he speaks of the concepts in question as "something like categories".

upon Kant's schemata.[93] Hall's revolt against exact methods was extreme, and he failed to employ them even in departments of "genetic" psychology where they might have done valuable service, *e. g.*, in work upon variations in sensitivity with age. But for the most part Hall's objection that the more controlled methods could be of little immediate aid to his problems was justified, and he chose the only one available for obtaining in sufficient quantity and form the data he needed. Many of his critics have held that Hall employed the questionary in a fashion not adequate to rule out its obvious sources of error.[94] The objections advanced are not without ground, and many of Hall's norms of behavior will undoubtedly undergo a shift in a direction away from the emotional and perfervid extreme. His use of statistical and other studies in supplementing the questionary, moreover, is open to the objection of over-epitomizing and under-evaluating; the labors of compilation have been immense, and the service is great, but more extensive presentation of mean variations and of critical interpretation in the light of method would have added much both to the labor and to the value.

Finally, the major assumptions of Hall's psychology have everywhere been called into question. The attacks upon the culture-epoch theory, the doubtful status of the doctrine of the inheritance of acquired neuromuscular dispositions, and the light shed by anthropology upon the true character of the mind of primitive man are too well known to require comment. Hall's phylogenetic interpretations and anthropological data are frequently not corroborated by workers in the fields in question.[95] Biology in Hall's hands often has a teleological ring, and the use of natural selection as a warrant for optimism is far from clear. The direct application of biological principles to consciousness arouses grave difficulties, however illuminating these principles may be when applied to behavior; such concepts as those of

[93] Why Kant is Passing, *op. cit.*, 373, "No experimental or introspective study of the processes of perceiving and comprehending things ever found the filmiest trace of any part of these schemata." Kant might have answered that his categories affect consciousness without penetrating it.

[94] *Cf.* esp. E. L. Thorndike, The Original Nature of Man, *Educational Psychology*, 1, 28-37. For a statement of the advantages and limitations of the questionary, *cf.* Titchener, *op. cit.*, Note 20, 387.

[95] *Cf., e. g.*, Van Waters, The Adolescent Girl among Primitive Peoples, *Jour. of Relig. Psy.*, 6 and 7, 1912 and 1914, 375-421 and 75-120.

"psychophores" or mental heredity are either figurative or purely mystical. Consciousness has a way of being most keen and pointed in moments of emotional flux, and often of lowering at more static periods. Accessory as well as fundamental muscles figure in earliest infantile reactions and throughout the course of habit formation. And similarly with reasoning, imagination, feeling; more careful studies show a gradual growth of these functions, extending to an ever widening subject-matter, rather than a sudden appearance at any one stage. Studies of the conditioning of emotional reactions indicate the possibility of very young children forming intense emotional attachments which in some cases may have permanent consequences.

The man of science marked by reserve, his enthusiasms conditioned to matters of method and system, intolerant of loose ends and contradictions, his eyes strained for the exception which may test the rule, evaluating his findings in the light of method and technique rather than in terms of their positive or negative character or far-reachingness, choosing his problems not without regard to his conception of the state of development of his science and their possibility of solution by reliable methods, will never count Hall among his fellows, however much he may value the contribution of Hall in pushing forward the frontiers of interest in science. For in almost all respects Hall is his opposite. Possessed of an enormous energy and vitality which unfitted him for the labor of patient attack on a limited front, he belonged in large measure to the type which includes new pioneers of imagination. The individual of this type must have great unifying instruments, ideas which almost at the first encountering leap into place and provide outlets for torrents which refuse to be hampered by the slow process of verification, but instead rush into new continents, whose tenability will have to be determined by later careful prospecting and examining. The dominant theme is its own category of criticism; results and theories are judged in terms of their possibility for unifying large masses of data or for promoting the dominant explanatory concept rather than in terms of consistency and method. One field after another becomes the scene of activity. In a mind possessed of impressibility and powers of rapid apprehension,

the drive of the idea makes possible a vast deal of reading, because of the adventure of finding grist for its mill, but it inhibits critical estimate of what is read. Nothing slows down the process; the thinker sees whatever thought it is that possesses him pervading and explaining the universe; he becomes almost a prophet, a mystic, an arriver at ultimate reality. So far-reaching in its possible effects upon human happiness and self-knowledge does the idea—self-stripped of obstacles—appear, that its possessor unwittingly turns propagandist. Such enthusiasm speeds abroad; many are inspired to specialize, and large audiences of workers are shaken and set about the task of application.

In considerable measure Hall approximates this type. He does not present it in its most rugged form, however, possibly because he never completely shook off the influence of the puritan outlook and doctrines among which he spent his earliest boyhood. His revolt, he tells us, created a certain sadness, a deep feeling of isolation, of being misunderstood, and he "confesses" in himself a certain apologetic strain.[96] This appears in a perceptible emasculation in his writings when he is touching upon such themes as would be most emotionally loaded for the conservative, somewhat smug puritan spirit. In connection with his handling of youthful "crimes", where certain remarks (quoted on p. 40) indicate insight into the need for a vigorous and searching analysis of the social structure in its responsibility for crime, he takes his main refuge in a view similar to the seriously discredited position of the Italian school, and refers to a "criminal type," to "degenerates," to the "animal part" of nature, etc., in a fashion that smacks almost of certain semi-theological treatments, although it has also a certain harmony with "genetic" psychology. His ascription to the savage and the child of traits present in the majority of untrained adult human beings—"With children as well as savages, truth depends largely upon personal likes and dislikes"—perhaps reflects the same temper. Still more does this trend emerge in relation to the treatment of sex, especially in its perverse manifestations, where occur expressions of a rather tense ethical character which ring strangely in a scientifically aimed treatise

[96] *Life and Confessions*, 594, 571, 575, 589.

and lead to uncertainty as to what fundamentally the author's position is. Some biographer of wisdom and insight, working possibly along lines of the same general direction as those laid down by Kempf,[97] may in time explain in a thoroughgoing fashion this trend, which more than any other prevents Hall's books from being an expression of genius, however much of genius there was in his personality.

But if in one sense Hall was too conscious of his puritan "folk-soul" audience, in another sense he was too oblivious of existing forms. His psychology itself was too much based on revolt, on complaint with existing philosophical systems as opposed to careful "inside" criticism of them, and was too anarchistic, to be likely to withstand the test of time. The refinement of concepts and critical studies in the fields of anthropology, psychology, and to a great extent of biology, failed to find sufficient place in his thinking to give his psychological work the alignment with progress necessary for permanent position and real contribution. And he made the systematic error of trying to find well-marked stages and distinctions in his given material instead of working out clear concepts which might serve as the basis of a scientific classification. In casting about for bases of comparison, in speculating as to what field would have furnished the most adequate outlet for his genius, one is tempted to consider literature. Where Hall is at his best, both his method and his observations have been essentially literary,—the products of insightful noting. This trait appears in the descriptions of youth and childhood, when the "psychonomic law" is temporarily set aside; in the description of the menace of modern civilization to youth; and in many other instances where he discusses practical needs and applications. Many of Hall's views have been expressed in different connections in literature; thus, one of his criteria of success, sympathy, is closely akin to what Anatole France recognized as a mark of genius.[98] He has a gift for the living word and phrase, a style which embodies the feeling of genius. But the fact of his just missing hardihood, or whatever it is which at times prevents complete absorption in his theme,—probably somehow related,

[97] *Psychopathology*, 1921.
[98] Gsell's *Opinions of Anatole France*.

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as we have suggested, to his struggles with his early puritan environment,—would have hampered him more in attaining greatness in literature; here, too, his leanings to propaganda would have been a more serious retarding influence, and also the lack of restraint in his style, the occasional figure which beclouds, the obscurity or repetition of figures which had strong appeal and are often very beautiful.

It seems not unlikely, then, that Hall found the type of work which could give his genius the best expression,—that of pioneer and prophet of a young and growing science sufficiently related to practical needs to offer opportunity for the enthusiastic propagandist. Here he could perform his most brilliant and distinguished service. Here lack of system was the least handicap, for the times were not ripe for system in psychology. His chief temperamental needs were socially polarized,—to extend, to impress students and others, to apply, to create opportunities for freedom and avenues for publication of work; and for this his style was supremely fitted. He was rarely equipped for the task of "generating interest over a large surface," which the worker, with his problems upon him, can turn into a narrow outlet; and from workers in the field of education have come the most enthusiastic tributes. Hall, the "passionate lover" of youth and childhood, has served youth more than anything else, and especially handicapped, adult-ridden youth. There is no field of education but has felt the influence emanating from him and has been markedly benefited; and if every worker who is concerned with the handling of childhood and adolescents were familiar with the assembled information, tenets and spirit of Hall's writings, a mighty stride would be taken toward the solution of the problems of criminology and a new day would dawn for youth.

SOME PRESENT TENDENCIES OF PSYCHOLOGY[1]

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In this address I shall not attempt to prophesy what Psychology will achieve or what changes it will undergo in the far distant future. My purpose is rather to examine present-day tendencies and, by contrasting them with the past history of Psychology, to reach some fairly valid predictions of the more immediately forthcoming developments of the science.

Hitherto, psychologists have generally adopted the physicist's methods of analysing composite into more elementary phenomena, and the physicist's thorough-going mechanical explanation. But the inadequacy of these procedures is fast becoming recognised. The doctrine, for example, of the association of ideas has proved by no means sufficient to explain the processes of recognition and thought. More careful introspection has discovered in these processes thoughts without words, mere acts of knowing and states of knowledge, which embrace far more than can be stated in terms of the elements of which the machinery of associationism is composed.

Psychologists are beginning to recognise that the elements which they have abstracted are conceptions which are never experienced as such, and from which—as such—living experience has never really been developed. For example, the perception of objects has not arisen, as many of the older psychologists supposed, from a synthesis of different elementary sensations. A sensation is an abstraction never actually experienced in isolation. The young organism's consciousness develops by the experience of 'situations' and 'objects'. The so-called 'complex' perception comes *first*, growing with experience in complexity, and analysed, as it thus grows, into so-called 'simpler' parts,—mere abstractions,—which by ultimate analysis become relatively lifeless, formless and meaningless.

Again, the comparison, or the association, between two experiences *a* and *b* does not involve merely these separate, isolated experiences, but the primary 'more complex' experience *a-b*, which must be treated as a unitary whole, and be regarded as a necessary precedent to the act of comparison or reproduction of the parts which may be carved out of it.

The psychology of the future will come to realise that the combination of simple mental processes into complex ones plays a far less important part in the mental development of the race

[1]An address delivered at Cornell University, August, 1924.

and in the mental life-history of the individual than the differentiation of vague, ill-defined wholes into parts and their crystallisation into clearer, cleaner-cut facets. The development of meaning in cognition, of emotion in feeling, and of purpose in volition is not to be described or explained in terms merely of originally almost meaningless sensations and images, of a hypothetically elementary series of feeling-tones ranging between pleasure and displeasure, and of blind impulse, respectively,—the mental atoms reached by introspection biassed by analogies from the realm of physics. Atomism of this sort can yield only part—no doubt an important part—of the truth in psychology and physiology. It deals only with mechanism and leaves out of account meaning, purpose and selective direction.

Yet another defect of this mental anatomy and atomism must be mentioned. Psychologists have been content to assume that dissociated parts of experience represent the elements of which the whole is made up. The psychology of the future must avoid such doubtful assumptions. The abnormal gait of a tabetic does not represent the ancestral gait at a remote epoch; nor do the personalities obtained under conditions of mental dissociation necessarily represent by-gone personalities.

There are still many who, on similar erroneous grounds, believe that the protopathic and epicritic systems, as conceived and distinguished by Head and his collaborators, represent two different stages in the evolution of cutaneous sensibility, that an 'all-or-none sensibility' preceded a 'graded' sensibility which alone permitted of effective spatial localisation and discrimination. It has likewise been supposed by Rivers that in the evolution of living forms instinct preceded intelligence, the latter representing a totally new system which suddenly entered, displacing or incorporating various parts of the old. It is not thus that evolution has proceeded.

The inadequacy and the unreliability of experimental introspection are becoming evident. In the Müller-Lyer illusion, for example, it has been found by Lewis and others that continued practice may gradually reduce and finally abolish the illusion, though the subject be throughout unaware of its presence or nature. Or again, the subject may in absolutely good faith advance reasons for his conduct based on introspection,—reasons which are mere rationalisations,—in place of the actual motives or causes of which, for various reasons, he is in utter ignorance. Closer study of post-hypnotic suggestion, of dreams, of multiple personality, automatic writing, somnambulism, etc., and of intuition, genius and inspiration, is clearly showing how much goes on of which introspection is quite impotent to give any account.

Indeed the view is developing that mind is by no means confined to conscious processes, that mental process—'mental energy', if we may use this doubtful term—must be conceived as something more fundamental than the consciousness of or belonging to the self (the only consciousness available in and for any organism), something which may or may not be accompanied by consciousness, something on which introspection may not always be able to throw light. Mind is thus coming to be conceived as something more primary than consciousness. Psychologists accordingly are finding it convenient (absurd as it may sound) to speak of unconscious, as well as of conscious, mental processes.

This conception of the unconscious mind is, of course, a mere hypothesis, affording a useful terminology in which to describe observed phenomena. The contradiction which, at first sight, seems to be an insuperable objection to combining the two terms 'unconscious' and 'mental' is not more serious than that involved in the physicist's conception of the ether, to which he has attributed qualities and properties quite unthinkable, quite unrealisable in actual experience.

The fact that conscious experiences are the subject's own private property and that they can never be communicated to others save by physical expression,—by gesture or by spoken or written language, *i. e.*, by movement, conduct or behaviour,—has induced some psychologists to endeavour to banish the mental element wholly from psychology, and to insist that scientific psychology means the study of behaviour, the study of outward responses. They claim that psychology can proceed without the consideration or employment of mental terms at all. What, in fact, they are doing is to study the behaviour of the organism for its own sake. They call themselves 'Behaviourists'. In point of fact, they are physiologists, observing reactions to stimuli in the intact organism, instead of—as in most physiological experiments—in isolated organs, tissues, or parts of systems. They have escaped the difficulty of dealing with mental processes, by ignoring, if not by denying, their existence. Such perversity breaks down in actual practice. The Behaviourists, as we see from their writings, cannot get along without employing terms implicative of consciousness. They cannot consider sensation, *e. g.*, colour vision and its defects, the varieties of imagery, processes of imagination, deliberation and the like, without using psychological language. Behaviour must certainly be studied by the psychologist. Psychology must include the investigation of nervous impulses, muscular contractions, glandular secretions and other activities which constitute the reactions of the living body. But nervous processes and the like are not *identical* with conscious processes,—sensa-

tions, percepts, ideas, decisions or emotions. Psychology studies bodily behaviour not, as the physiologist attempts to study it, for its own sake, but for the light it throws on mental processes and on the relation between them and bodily processes.

What this relation may turn out to be it is, of course, impossible to predict. But it is quite likely that neither of the two chief alternative hypotheses now offered may prove ultimately acceptable. It may well be that nervous process and conscious process are not to be regarded as running *parallel* with and separate from one another, like the opposite surfaces, the inside and the outside, of a curved mirror. It may also well be that nervous process and conscious process cannot be crudely conceived as *causally* interacting one on the other. We may one day come to realise that mental and nervous processes are fundamentally inseparable, and that their distinction is possible only by abstraction, the use of which is justifiable only because without it scientific research cannot be carried out. If we consider 'mental energy' as spread far wider than (and not necessarily always associated with) consciousness, there is no part of the nervous system in which we can logically deny its presence. It becomes coexistent with what we term nervous energy, which is itself but a specialised form of the energy of living substance. Because electrical manifestations are all that we know of nervous energy, we are not justified in saying that there is naught but electric energy in the activities of the nervous system. So too, in living matter generally, while physical and chemical reactions are undoubtedly present, who can be certain that we shall not be compelled one day to recognise that such physical and chemical energy is harnessed to, nay rather is manifest as a degradation of, still higher forms of inherent energy, which distinguish the living from the lifeless body? In particular, may not the electric responses accompanying nervous impulses be merely the result of degradation of such a higher form of energy, and may not this 'psycho-neural' energy, as I propose to term it, take on a more specifically *mental* form, as higher nervous tissues, especially the cerebral hemispheres, become involved, and as these higher structures come to be distinguished by increasingly plastic, interdependent and complex functions, as contrasted with lower functions relatively fixed, isolated and simple?

Does mental activity differ so widely from material, above all from vital, activity as hitherto philosophers have taught, and as the general and the scientific public still suppose? Let any one who wishes to answer this question impartially consider the nature of matter according to the most recent hypotheses of physicists. What remains of substance but localised, corpuscular centres of electrical energy, set (perhaps it may be

necessary to suppose) in a frameless, almost inconceivable ether? And what is to prevent us in the future from supposing that such energy may be raised to still higher powers in the form of consciousness? I know nothing, not even the doctrine of conservation of energy, that would make such an hypothesis *a priori* impossible.

What psychology and physiology will have to face is a common problem,—that both in life and in mind there is something which differentiates them from the activities of lifeless substance. A living organism is continually engaged in building up higher from lower forms of energy, in making living substance which is continually breaking down into simpler bodies and liberating simpler, more degraded forms of energy through its own ceaseless activity. Outside the living body, such constructive anabolic processes fade into relative insignificance or occur only under artificially arranged conditions. The lifeless world is characterised by a degradation of energy rather than by progress into higher and still higher forms. *Pari passu* with this distinction, which becomes more evident as we ascend the evolutionary scale of living forms, purpose comes more and more prominently on the scene as something superadded to the apparently blind mechanism of isolated non-living bodies. The living organism is characterised by a struggle for self-existence; it *selects* its environment for the purpose. And it is this 'purpose' that characterises both life and consciousness, dependent on a plasticity, an adaptability, which increases from the lowest forms of living matter to the highest and most developed regions of nervous matter, beginning with a 'purposefulness' imposed on the organism, ending with a 'purposiveness', *i. e.*, a self-consciousness fully realising the existence of purpose, as well as of mechanism, in its activities.

Both physiology and psychology can make, and have made, progress on the supposition that our vital and mental functions are determined by mere mechanism. So they are,—but that is not the whole story; it is a mere abstraction essential, as I have already said, for scientific research. The imperfection of this view is becoming increasingly glaring. All that natural science can say is —given such and such conditions, such and such results must follow. But prophecy of what will follow is possible only within the narrowest limits; it can only be determined by, and based on analogy from, past experience. Who could have foretold that the properties of hydrogen and oxygen, when chemically combined, would yield the totally different properties of water? Who could have foretold the properties of radio-active substances, or the appearance of new living forms in the course of evolution? When once we know all the conditions determining these results, we can safely assume the blindly

mechanical standpoint of natural science, and say that, given a repetition of certain conditions, certain results can be anticipated. But are the conditions and their results given merely by chance? Is there truth only in our experience of mechanism, and is our experience of purpose, of the employment of means to an end, a mere illusion? Are variations in living forms merely continuous, blind, accidental and preserved by their suitability in the struggle for existence? Or may they not arise by sudden discontinuous leaps and bounds, and be indicative of some perpetual directive attempt at harmony between the environment and the responses of the organism? Are the marvellous instincts, say in the insect world, explicable by chance variations? Are they even explicable as the inherited habits of acts determined and learnt throughout countless former generations?

Few thoughtful modern biologists would be satisfied with a reply to such questions in the affirmative. Determinateness undoubtedly exists in life, but it is only a part of the whole truth. So it is in mind. We may agree with those psychologists who assert that, given such and such conditions, such and such results must occur. But can we say—given such and such an end, or an obstruction thereto, such and such behaviour will appear so as to achieve that end? Clearly, prediction is possible only within the narrowest limits. Creation, the construction and differentiation of the new, is always proceeding in mental, as well as in biological forms. New thoughts occur, both as conscious creations by the purposive self, and as the 'sports' or inspirations of genius, unconsciously elaborated and presented to the conscious, more fully purposive self for intelligent criticism and acceptance or rejection.

The physicist has always endeavoured to foist physical conceptions on to the psychologist. Fechner endeavoured to change Weber's law from its actually relative to an absolute character. Since then physicists have largely adopted the standpoint of relativity which has long been so prominent in psychology. Psychology has been silently insisting that physiological inhibition is not the mere negation, or absence, of activity, but is itself an active process. So, too, in the future I have no doubt that physical science will recognise that there is more in heaven and earth than is now dreamed of in physical philosophy; that mere mechanism is only a partial expression of the energy of the universe and that, in addition, there lies a directing, differentiating factor immanent in the universe as a unitary system, still further developed in the unitary system of the living, individual organism, reaching its climax in the unitary system of the mental conscious, individual self. Mechanical energy is the blind, purposeless activity that makes a train travel along its rails. But there must be an 'energy' responsible

for a higher kind of work, which directs the train now along one, now along another of alternative paths, in conformity with the needs of the environment and with the preservation and evolution of the universe, the living organism and the conscious self. Is it too fanciful to see the germs of this view in present-day attempts to combine into one comprehensible scheme the two conflicting, but necessary, hypotheses, the corpuscular and the undulating conceptions, of light, the corpuscles apparently representing the luminificent machine, the other the directive vehicle of its energy?

With the first appearance of consciousness, purposefulness, as I have previously stated, becomes translated into purposiveness. By that I meant that purpose not only exists in the universe, but that the living organism becomes conscious of purpose in its own activity. Consciousness, we shall come to recognise, has been evolved for the prime object of purposive choosing,—the choosing of the best of alternative responses, and the choosing of the best of surrounding stimuli. What there be of rudimentary choice in lower mental systems becomes developed, differentiated, distilled as it were, within the highest mental systems. Behaviour or conduct in the living organism is to be regarded not, fundamentally, as a mere blind mechanical conflict between purposeful instincts, each with its own driving impulse towards activity; it results rather from the sanction of the directive, purposive self, the function of the highest and most plastic, complex regions of the nervous system. In illustration of this, let me point out that an instinct differs from a reflex in that it is imperfect in performance on the first occasion of its appearance, and in that it is improvable by experience. Thus instinct must come to be regarded as involving, and as being inseparable from, intelligence.

The situation which calls for emotional behaviour makes a dual appeal to consciousness—a *cognitive* awareness of the situation, as well as an *affective* reaction manifested as excitement, depression, appetition, aversion, interest, fear, anger, sexual feeling or the like. But none of these affective changes is to be considered as bound up with merely one definite instinctive expression. Thus, to achieve its end, the sexual feeling may manifest itself in various reactions,—by courting, by attack, etc. So too, fear may manifest itself in flight, in (rigid or flaccid) quiescence, in fighting at bay, in clinging to the parent, etc. Moreover, it will be realised that each act that forms part of an instinctive reaction, *e. g.*, a bird's spreading of its feathers, may be connected with and evoked by more than one kind of situation or affective experience associated therewith, and that many instinctive reactions—for example, those connected with sex and reproduction—form a chain the links of which develop

at different periods of life determined by chemical stimuli (hormones), by external environment, by heredity and by experience.

We see now more clearly the important function of consciousness,—the process of selection from among alternative reactions, which culminates in deliberate choice. This selective function enables the Ego to choose which of alternative reactions to the environment it shall evoke, and—most important of all—to discover appropriate stimuli, that is, to choose its own environment. The Ego is the final court of appeal for all volitional conduct. Aided—even burdened—by its vast experience, and by the interests and sentiments derived therefrom, it may at one time strengthen the impulse of one of alternative motives, while at another it may weakly sanction, or even passively observe, the issue of an irresistible impulse, the development of which may have been unconsciously, but by no means purposelessly, determined in conflict with other antagonistic unconscious impulses. Some day it may even be proved that we inherit mutually incompatible mental characters, one or other of which may be similarly selected or inhibited, now at one period of life-history, now at another, by unconscious direction.

If, on the other hand, each situation gave rise only to one single possible reaction, the sole remaining function of consciousness would be to assure that the situation did produce its own effects. This would be and is achieved by maintaining the situation, by facilitating its effects on the self, and by inhibiting other effects that might interfere with the bodily activities which the situation would naturally evoke,—in other words, by preserving a favourable attitude of the self, or attentiveness. No doubt this function is especially related to the affective modes of consciousness: emotion-feelings have been developed for the very object of preventing other consciousness from entering into the experience of the Ego and from interfering with the expression of those feelings.

The environment, as most now believe, acts on the organism by releasing its internal energy. The striated muscle-fibres and certain sensory end-organs secrete material which is stored up, ready to explode, as it were, after the receipt of the appropriate stimulus. Somewhat similarly, parts of the central nervous system have been regarded as mapped out into mechanisms which are thrown into action on the receipt of the appropriate stimulus. Thus psychologists have come to look on the stimulus as merely a trigger mechanism, which enables the organism to fire off its appropriate sensory or motor response.

But the psychology of the future is likely to see the inadequacy of this view. Muscle-fibres maintain a variable state of partial contraction throughout their life,—exhibiting what is

known as 'tone',—without signs of fatigue. So too posture can be preserved and daylight can be tolerated for hours without signs of fatigue. We are beginning to recognise another living function besides that of intensive momentary explosion,—namely, the function of long-continued extensive 'set' or 'attitude', involving, and involved in, the simultaneous control over antagonistic activities by adequate facilitation and inhibition. Such control we see on a higher plane in the attitude of attention, the long-continued set which at the same time involves an inhibition of themes or acts which would conflict with the maintenance of the theme or act under attention.

At lower levels such reciprocal inhibition is reflexly involved in all muscular action. When the spinal cord calls forth flexion of a limb, there is simultaneously set up inhibition—active relaxation—of those muscles that would otherwise extend the limb. It is important to recognise that actual work is performed in effecting such inhibition. On the higher levels we recognise it at once in the conscious or unconscious repression of emotional experience and in the resistance with which such repressions meet in order, as we say, to re-enter consciousness. But, to revert once again to the spinal level, poisons such as strychnine or tetanus may, as is now well known, convert such reflex inhibition into reflex excitation, whereupon every attempt in the spinal cord to bend or to extend a limb brings in simultaneous contraction of opposing flexors and extensors and hence produces the well-known spasms. Thus the functions of the nervous system at a given point are so 'poised' that at one time inhibition, at another excitation may result. Such reversals are especially characteristic of the cerebral cortex, where stimulation of the same cortical spot may at one time produce extension, and at another flexion, yet at another both extension and flexion simultaneously.[2] Here, once again, we meet with a kind of directive agency superposed on, or should we not say integrated with, blind mechanism; a reversing gear or, more generally, a setting of the points, as it were, now in one direction, now in another, now keeping both open, according to internal conditions and requirements.

I believe that psychology will come to recognise this fundamental difference between 'act' and 'attitude', using the former term to denote the firing-off of momentary reactions, and the latter to denote that prolonged activity of the living organism involving directive setting, and consequent activity in reciprocal facilitation and inhibition.[3] According to this view, inhibition

[2] Cf. Graham Brown and C. S. Sherrington, *Proc. Roy. Soc.*, 85, 1912, 277.

[3] Is it too fanciful to seek an analogy in the physicist's conception of definite forces locking at definite points the molecules in a crystal or the atom in a molecule, and so exerting a directive attitude in regard to the whole unit?

is an active process,—not the effect, as some have supposed, of the mere drainage of energy into those paths which are at the same time excited.

They who hold the latter view are naturally inclined to regard the central nervous system as possessing a 'common fund of energy', which may be drained now in one direction, now in another, according to the needs of the organism. The same conception has given rise to the notion of a factor of 'general intelligence' which can be employed now in conjunction with one specific ability, now in conjunction with another.

But the existence of a general factor of intelligence—which, we must bear in mind, is merely a useful working hypothesis, as yet unproven—may be considered from a different aspect, that of evolution. It is conceivable that the different specific abilities in which general intelligence is believed to play a part may really involve different specific intelligences, which have been differentiated out of such general intelligence and for that reason—because of their common ancestry—share in a common factor or feature.

The idea of drainage of energy of some general ability now into one part of the brain, now into another, is an outcome of the still prevailing view that different conscious processes have their seat in different parts of the brain. Physiologists, or rather neuro-pathologists, have for two generations past been endeavouring to map out the cerebral cortex into various sensory centres and sensori-psychic centres in which they suppose visual, auditory and other sensations, perceptions and images to be respectively developed. I am confident that future psychology and future physiology will discard this notion in favour of the view that there are no separate seats of consciousness in the brain, but that consciousness involves activity throughout a very wide region, if not throughout the whole, of the cerebral cortex, and that such terminology as the 'splitting' of consciousness is inadmissible.

For many years now, as a teacher of psychology, I have been wont to emphasize, by the following illustration, the fallacy of inferring that, because blindness or deafness results when a specific area of the cortex is destroyed or interfered with, therefore that area constitutes the 'centre' in which those sensations are produced. If I had to travel by train from Cambridge (representing the stimulus) to King's Cross (representing the correspondent consciousness), it would be absolutely necessary for me to pass through Hitchin. A block occurring at Hitchin would make it impossible for me to reach King's Cross, but I should not be so foolish as therefore to identify Hitchin with King's Cross,—to identify the seat of the block with the centre or seat of the particular consciousness. So too when a given

cortical area suffers injury and the lesion results in some particular loss in consciousness, we are justified in saying only that the integrity of that area is essential for the development of that particular form of consciousness, just as an open path at Hitchin is essential for me to get to London.

I remember communicating this view some twelve years ago to the late Sir Victor Horsley, and it is noteworthy that within the last few months it has been independently enunciated by Henry Head mainly as the outcome of his researches into aphasia. Hitherto the preconceived ideas of neurologists, together with their ignorance of general psychology and their lack of training in the psychophysical methods,—that inestimable legacy of experimental psychology,—have led them to fit the facts of their cases to their theories. They have thus adduced evidence for at least four centres of word-memory: "(1) the auditory word-centre, where the sounds of words are registered; (2) the visual word-centre, where the visual images of letters and words are registered; (3) a glosso-kinaesthetic centre, where the combined impressions which pass to the cortex as the result of movements of the lips, tongue, larynx and other parts concerned with articulate speech are registered; and (4) a cheiro-kinaesthetic (eupraxic) centre, where the sensory impressions resulting from movements concerned in the act of writing are registered."[4]

I have no doubt that the future will prove the absurdity of the conclusion that different kinds of word memories are registered in different centres of the cerebral cortex. Even a neurologist like Head whose psychological insight is acute may fall into a similar fallacy, as when he attempts to deduce the kind of consciousness which he supposes to be inherent in the optic thalamus. The thalamus cannot be regarded as a 'seat' of consciousness. In the future we shall come to recognise that there is only one consciousness—the consciousness of the self—and that there are no special seats of consciousness, although different areas of the cortex and the thalamus are differently involved in producing special kinds and characters of consciousness. But the demarcation of these areas is far from constant, and if they be but slowly destroyed other areas may readily take their place. Even after relatively small sudden lesions, and even after the loss of a considerable amount of cerebral cortex, remarkable recovery may still take place.

So far we have been dealing with the views likely to be held by psychologists in the future. Meanwhile psychological research still proceeds, dividing up investigations, just as ceaseless research divides the investigations in other sciences, into

[4] *A System of Medicine*, edited by Sir Clifford Allbutt. Article "Aphasia" by Bastian and Collier.

compartments of specialists, each unfortunately so separated from the rest by water-tight doors that workers find it difficult to obtain a good view of the progress of the subject in its entirety. This differentiation seems likely only to increase in the future; it is only to be hoped that the accompanying isolation may be reduced. In one direction we see the workers in laboratory psychology, dealing with problems of general psychology; in another, psychologists concerned with behaviour, human or animal; in a third, those studying individual and racial mental differences; in a fourth, those comparing the behaviour and the institutions of social units; in a fifth, those investigating the mental changes which may be associated with disorders and diseases of the mental and nervous systems or may occur from accidental or experimental lesions; in a sixth, those engaged in determining the nature, number and interrelation of 'general', 'group' and 'specific' abilities; in a seventh, those studying the best conditions for the exercise of those abilities in the individual or for their transmission to future generations. We may even foresee a group of psychologists occupied in scientifically examining the purposeful unconscious mental archetypes, supposed to occur by Jung, or the spiritualistic claims of what is known as 'psychical research'.

And so we reach an aspect of psychology which has hitherto received no attention in this paper,—its application to everyday and possibly to future life. The prospects of Applied Psychology are already so dazzling that from very fear of exaggeration one hesitates to attempt an estimate of its possible developments.

For even already the progress in Industrial Psychology has clearly demonstrated the assistance which can be rendered by vocational guidance, by vocational selection and by the study of the worker's movements, his spells of work and rest, and his environment, in enhancing not only the health and the happiness of the worker but also the efficiency of his work. With the right man on the right job, with his needless efforts eliminated, the most advantageous arrangement of his material, the most effective distribution of his hours of work and rest, and the most healthy conditions of light, temperature, ventilation, etc., installed, what a Paradise during man's working hours can be envisaged!

Not less promising are the advances in abnormal and educational psychology,—especially in the prevention and treatment of mental and moral disorders, in replacing the current, often unjust, but easily workable conceptions of crime, responsibility and punishment by views that are truer, and more generous, however unwelcome to psychologically untrained minds; in providing suitable education and social environment

for those persons whose mental and moral abilities demand special consideration; and, above all, in spreading wide that knowledge of the working of our own minds which will enable each member of a social unit effectively to control not only his own conduct but the conduct of his fellows according to his own legitimate desires or according to the dictates of the social unit of which he is a member. The future of applied physical, chemical, and biological knowledge pales beside the promising brilliance and the inestimable human value of the application of psychological science.

THE REALITY OF CHANCES

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The problem set by Leibniz for the Enlightenment is not ended, for the problem of the individual is still the problem of philosophy. The besetting anxiety of present-day speculation, whether in science, theology or philosophy, has been to exorcise ghosts. Man, said Plato in his *Republic*, is as a spectator in a cave who sees nought of real things save their shadows cast on a wall. Thus, by an amazing irony, man by reflection rids nature of ghosts only to find himself among the shadows that remain. The "spirit of enquiry" took its rise with the denial of that animism of primitive man which sees nature as peopled with spirits. The forces of nature cease to be gods and become potter's clay in the hands of man. Of course, this denial of spiritual power in nature was an implicit assertion of the reality of spirit in man.

But the mechanistic conception of nature has been a dear price to pay for the laying of the ghosts of magic and superstition. It appears that ghosts will not vanish ungrudgingly, and maintain an irritating capacity for keeping themselves talked about. Worse still, it now appears that, exorcised from mountain and stream, they have avenged themselves fully, for the 'liberating doubt' has overreached itself and cast its pall over man himself. Since the days of Hume and Berkeley philosophers have been in the uncomfortable and ludicrous strait of deciding whether we are haunted by ghosts or whether they are haunted by us. The unhappy circumstances have been that in our inveterate thirst to find one solution for all problems, mechanism, which lays the ghosts of nature, has been allowed, grotesquely enough, to make ghosts of ourselves.

I shall assume in the present paper that the atomic theories of biology: the 'gemmules' of Darwin, the 'pangenes' of De Vries, the 'physiological units' of Spencer, and the 'determiners' of Weissmann, are all inadequate to the concept of life. For biologists to regard the shadow dance of these units as the explanation of life appears to me as intelligible as a discourse on "whiteness which is green." If we are to solve the mystery of what we call life, we shall have to look elsewhere than to the statistical arrays of biometry. I shall seek to establish this claim, however, not by considering mechanism directly, but by considering so-called finalism. Finalism is the alternative that the Platonizers in philosophy have championed as the correct alternative for mechanism. However, I shall try to show that finalism is itself, as Bergson aptly expressed it, but

"mechanism inverted." The mechanists have preferred the principle of chance as the basic principle for their constructions, and the finalists have declared themselves in favor of a supra-personal principle. They have dichotomized existence into absolute chance on the one hand and absolute teleology on the other. Both are deterministic: mechanism gives a determinism 'from below' and finalism a determinism 'from above.' I shall attempt to show that as far as the reality of freedom as a psychological experience is concerned, both theories are incompetent. Secondly, I wish to present my reasons for the belief that the true ghost to be exorcised is the 'passive fallacy' of intellectualism, which is responsible for both of the abortive substitutes offered in the name of selfhood in the form of mechanism and finalism.

What are the factual data in the lives of men that give rise to the idea that they are personalities? Centrally, I believe it is the inexorable truth that *selfhood is coextensive with the perpetual making of labored choices.* It is this striving nature of life that neither the laboratory of science nor the logic of intellectualism can understand. Science by the very nature of its method is bound to find only chemical machines in organisms. Now all machines have every choice decided for them in their very construction; and as for labor, they are one and all completely yielded to their inertia. How, then, can any scheme of mechanism embrace that most typical characteristic of life, its capacity for creative effort? On the other hand, intellect can give us only this mechanistic account inverted, that is, it can only express the labor of life in terms of an absolute teleology. Mechanism and finalism both offer the mere apparitions of life. From either view, choice is unreal, labor is unreal, chance is unreal; and an image so shorn of the warmth of life is not a living personality but a ghost.

How could the unguided chance of science produce the Iliad of Homer? A child, it is said, not knowing Greek, will believe this combination of the alphabet as 'natural' as any. But the performance will seem natural only so long as the child remains ignorant of its meanings. Similarly, when biologists tell us that organisms have been created in this way, we reply that they have accounted for the *how* of a thing by the price of an unanswerable *why*. Science has adopted the theory of chance origins to patch up its deliberate neglect of teleology. That is, since it will not define an organism in terms of its purposes, it defines it in terms of its chance origin. But does the origin of a thing define its nature? That of a chemical compound apparently does. But this cannot apply to living creatures, because the antecedent states that we seek to define it by are inexhaustible; we no sooner utter its 'formula' than it has grown

apace. To define life in terms of its origin were to relive it; and to live life teaches that above these configurations of the organism there is the stinging experience of labor which fits into no logical mould. Life indeed lives by a rule of chance, but it is very different from the mathematical chance with which the modern biological atomist trades. There are two distinct kinds of chance: the chance of getting a certain result when a given number of results are possible, and the chance of getting a result desired when the number of alternatives is not given. The first sort of chance belongs to mathematics, and the second belongs to life. We are astonished that a mathematical chance combination of words should give us the Iliad because our reason is easier to mislead than is our intuition, and it is our intuition that is in this case astonished. The particular configuration of words that gives the Iliad may be as natural as any, but the meaning they express is a most unnatural result—unnatural because the meaning could not have been present as a given possibility. The presence of meaning and beauty in the poem could have arisen only as all beauty and meaning arise, from the law of chance which is at once the law of life: the chance "to be or not to be." Thus, between the 'cannot happen' of mathematical chance, and the 'has happened' of finalism, all dynamism is stranded, all psychology becomes scepticism. In a scheme either of pure chance or of absolute teleology, choices are impossible, and to make choices is coextensive with life. In support of this thesis, I shall now parallel this discussion of the results of the theory of chance with a discussion of the implications of the teleology of the absolutist philosophers.

We may take Hoernlé as a fair representative of those who invoke "the order of nature," as they call it, to resolve the enigma of life. Hoernlé completely rejects vitalism "whether biotic energy, or entelechy, or *élan vital*—which yet has the power by way of regulation or control with the physico-chemical processes in the body . . . which can select for realization one of the physically open possibilities[1]." We shall see that with this rejection of psychic causation and the psychic fact of choosing he has already yielded the entire debate to the mechanists; for teleology can under these circumstances only be mechanism in euphonious disguise.

Presently Hoernlé defines his conception of teleology: "When we speak of teleological concepts, we do not mean a design, or plan, or purpose, or desire consciously entertained by any mind, be it of God, of man, or of plant." Here the amazing contradiction he enters upon is complete. By the use of the concept *value*, he says, the efficient cause of mechanism becomes

[1] *Studies in Contemporary Metaphysics*, 1920, ch. 6.

the final cause of teleology. Yet he assures us that a value is not such because it is desired in any way. It is valuable because it serves a purpose, but purpose too means something different from what ordinary mortals experience, being immanent and unconscious. We are of course curious as to the meaning of this 'immanent purposiveness' and we are soon to learn. "When we ask," he says, "what character in natural objects, or in nature as a whole, exhibits this immanent purposiveness, this 'design' most clearly, the answer must surely be that it is organization."

What shall we say of this so-called solution? Hoernlé was right in saying that the difference between a machine and an organism is a certain teleology in the latter. But his teleology is meaningless because it is one without a problem, without real choices, and accordingly without life. His 'organization', like a machine, has purposes, not for itself, but for some other agency. Like a machine, it has all of its problems specified and solved in advance. In truth, in place of a machine, Hoernlé gives us mechanical theory. Vainly does he try to show his concept of the organism as different from mechanism. A machine involves *causes* and *effects*, he declares, while an organization, which is the pattern of life, involves *means* and *ends*. Yet, when we ask what are the means and what the ends of the organism, to remain consistent with his definition of teleology he declares that the parts of an organization are the means and the whole is its end. What strange being is this whose sole purpose or end in existence is to be the sum of its parts? This is surely too mild a rendering of that turbulent drama which we call life. Most paradoxical of all, not only is this as much a ghostly distortion of life as the mechanism which Hoernlé rejects, but he also ends by admitting the vital principle he abhors. He set out to construct an immanent organization that is without "design, or plan, or purpose, or desire;" but is the exercise involved in being an 'organization' so mild as all this? A physical organization could indeed persist with no expenditure except inertia, which is of zero value. Hoernlé is of course seeking to render a consistent account of life as an organization of ideal order; and as such it maintains its integration only by the effort of memory. It will be apparent, then, that we have here all the dynamic strife of life disguised in words. Again the 'passive fallacy,' which refuses to see that the recalcitrant facts of freedom and responsibility, which the intellectualist abhors because they upset all prediction and all logic, must be explained and not denied.

As for our freedom, it is perhaps because simple fiats of will are so ordinary in our lives that they have given rise to that threadbare enigma of psychology, the problem of determinism.

To the query of St. Paul "Hath not the potter power over the clay?" daily experience gives an unqualified affirmative. But dialectic has almost invariably ended with a determination of either a 'hard' or a 'soft' variety. A volitional act possesses an unique character to which mechanical schematism is wholly inapplicable. It is impossible to imagine that the units of an interacting system exert effort; on the contrary, each of them is completely yielded to its inertia. To be in space is of necessity to be subject to all of the enforced movements of space. Every body follows the path of least resistance, we say; but even here we dramatize, for the least resistance is at least *some* resistance. Here is an intrusion into our purest notion of the mechanical, the ineradicable belief that wherever there is motion there is life. However closely we examine the intervals between changes of physical state we shall never discover a *cause* in its true sense. All we shall find will be intermediary states as before. Thus the gaps between states of change, instead of being bridged, become more numerous than before. Cause cannot be discovered in physical nature as such because *the bodies of space are incapable of initiative.* We shall never be able to conceive of causation in the true sense of the word unless we seek for it, not in the realm of the mechanical, but in the realm of the vital. The experiences of causation and of time are inextricably bound together; and so intimately are they parts of life that they are in a true sense life itself. Hence the volitional and consequently moral scepticism of Hume and all others who seek to comprehend life and responsibility without admitting the reality of time. Bosanquet argues that true causation is independent of time, since the more completely we know the ground of an event, the less significant time is[2]. If finding causes merely consisted in finding antecendent conditions and events, then we are logically compelled to say that the universe is the cause of all things. This, the conclusion of J. S. Mill, is practically saying nothing at all, for it leaves us none the wiser concerning the particular causes we are in search of. Practically, we never look for all of the antecedent conditions, but single out a few that must serve by proxy for the universe as a whole. In the classic example of the cow that set a city on fire by kicking over a lantern we single out the cow and the lantern as the causes and wholly ignore the city and the rest of the universe, because this limitation lends itself nicely to the problem of the prevention of fires. So in the courts of justice: a stone dropped to earth will jar the entire universe, but the judge confines his survey of effects to the unhappy person who was struck by it. What rule decides which particular antecedent factor will be selected to be the 'cause?'

[2] *Logic*, bk. 1, ch. 6.

Clearly, we designate that antecedent as cause which we can control. Thus, it is only as a metaphor that we speak of causes in nature at all, for in all such instances the true causal agency literally intended is a living one. *It is only mind that can cause and it is only mind that can be effected in any intelligible sense.* To be a cause is far more than to be an antecedent state: to cause is to labor and to labor is to overcome resistance. Labor is the price of all creations. The God of theologians is said by them to be able to create universes at the mere behest of thought; but the inconsistency arises from the brute fact that thought too costs an effort. Moreover, it is an effort made under the hard terms of a law of chance which gives no assurance of victory. We have here the true realism of chance and the true realism of life. The chance which science has conceived is a chance with a calculus; but the chance by which we live is real, not because its history can be computed in advance, but rather because it cannot be so computed. It is a realism fully expressed by the phrase "to be or not to be." By what magic does the chance taken by life upset all prediction? It is always because life seeks to transcend the bounds of the given; that is to say, it seeks to transcend the bounds of repetition. Again, this is to say that this sort of chance cannot be escaped because of the effects of time, for it is time that makes exact repetition impossible. If the tropic responses of the hydra will not fit into the statistical mould it is because the hydra learns. Yet it learns so slowly that there is sufficient repetition to make a law of probability of some use in predicting its conduct. What of a new coin, which at first satisfies the expectation 'fifty-fifty' but progressively disappoints it because its edges wear on one side or the other? We must say that the formula is not realized here because the coin, like the hydra, is subject to the effects of time. The hydra progesssively learns while the coin progressively "unlearns" the form given it. When we cast loaded dice, we succeed each time, thanks to 'the uniformity of nature.' When we cast unloaded dice, we may still succeed if we are patient; here chance loses its calculus, and, for once, chances have to be 'taken.' The law of chance is indeed none other than a law of patience; only in this sense can it be truly empirical. It is indeed the most ancient of all the laws of life. It is the "trial and error" of the amoeba which the philosopher too employs where the majority of 'concepts' created in hope are destined never to endure. And of mathematics too it may finally be said that its true business is to take chances and not to define them. It is a notorious fact that never in its empirical researches does science get results that exactly correspond with what chance prediction warrants. In truth, as Poincaré has admirably shown, the very notion of a 'calculus of probabilities'

is a paradox. What would be the chance of selecting out of an urn a white ball when it contains only white and black ones but it is not given how many there are of each? There is no calculus that can tell us. Yet it is just such problems that we must solve as the price of evolution to a freer life.

Conclusion.—In the acute form in which the problem of individuality appears today, a thousand issues of the past have come to a head. The decision between the three alternatives of mechanism, finalism and vitalism does not rest finally on reason, but rather on a sort of conscience within us. The problem at issue is not a logical contention concerning the existence or non-existence of mind. The logical differences concern only the question which of the three hypotheses is best suited to account for the facts of mental life. It has so far been the purpose of my treatment to show that neither mechanism nor finalism can render a consistent account of life. Yet the results of such a criticism are wholly negative so far as the positive meaning of life is concerned. For that positive understanding I believe we must go to immediate experience and to introspection. That we are free and responsible, that we labor and risk failure, were not taught us by dialectic. The whole history of philosophy is a monument to the truth that there are, as James expressed it, certain views of the world in which we cannot "feel volitionally at home."

Thus viewed, vitalism alone justifies the reality of will, of pain, of effort, and of decision: all of which are constantly present in life and consciousness. Mechanism awakens a quick rebellion, not so much because of its fallacies as because of its history. It has been invoked by pessimism to explain its failure, by gross hedonism to justify its weakness, and it has given plausibility to the ambitions of oppressors. Thus, in its history as well as in its principle, there appears its incapacity to represent the phases of experience that make up the richest part of life as it is actually lived. Finalism, on the other hand, seeks to escape the weaknesses of mechanism by the futile expedient of accepting its essential meaning under the guise of the more innocent baptism of 'immanent organization' or some such euphonious term. Like Plato's spectator we are bound by a chain that somehow we cannot make ourselves believe is an apparition like the other things about us. This is the chain of loyalty to something creative within us, a chain which to lift is heavy labor.

PROGRESSIVE RELAXATION

By Edmund Jacobson, M.D., Ph.D., F.A.C.P.

For the last six years, a new method to bring quiet to the nervous system has been in clinical use with more than sixty patients. The method first suggested itself during experiments on the involuntary start begun at Harvard University in 1908. Related studies were later continued at Cornell University,[1] and recently, thanks to Professor Carr, at the University of Chicago.[2] Neither these experiments nor the method itself are to be featured in the present paper, but rather certain observations concerning the quieting of psychological activities. Clinical records have been made with great detail, and the interests of investigation rather than merely of therapeutics have been paramount. In particular, about ten qualified patients received a specially prolonged training in psychological observation; and their reports were supplemented in 1922 and 1923 with the aid of thirteen subjects in the psychological laboratory and two in the physiological laboratory.

The problem of diminishing cerebral activities may prove of interest to every psychological school of thought. Students might differ in describing the purpose of the present investigations. Clinicians might see it as a search for a sedative for overactivity of the cerebrospinal and autonomic nervous systems, or for a means to reduce nervous irritability and excitement. Others might say that the search was for a physical means to diminish the psychic processes of an individual at a particular moment or over a period of time, including what James might have called the stream of consciousness, what Wundt and Titchener might have called the state of attention and perhaps also the processes of mental imagery and kinaesthesis, what Marbe and Ach and Watt might call the thought-processes, what Watson and the behaviorists might term subvocal speech, and what every one knows as the emotions. In all of these various expressions for the whole or some part of experience, there is one point of general agreement: each of these writers conceives the occurrence he names as having essential physiological accompaniments. It might therefore be possible to find among such various physiological accompani-

[1] E. Jacobson, this Journal, 23, 1912, 345-369.

[2] A systematic account of experiments on the involuntary start will soon be published by Miss Margaret Miller.

ments some universal component, which might be diminished, or momentarily eliminated, in order to produce a corresponding psychological effect. Doubtless, a study of the data later to be presented will make the problem more clear and open to interpretation in the terms of the reader's choice and experience.

Interest may perhaps be added to the present report, if we first recall some views of various authors that harmonize with our results. The writer is not seeking to prove a motor or any other theory of consciousness, nor was Külpe when he said:

> "It is important to emphasize . . . that reproduced sensations are by no means the only aid to recollection . . . Very intensive impressions are usually sensed not only by way of the organ to which they are adequate, but by others as well. *Movements are everywhere important.*[3] It is perhaps not too much to say that a voluntary recollection never takes place without their assistance. When we think of intense cold, our body is thrown into tremulous movement as in shivering; when we imagine an extent of space, our eyes move as they would in surveying it; when we recall a rhyme, we mark its rise and fall with hand or foot. Most important of all, however, are the movements of speech, which stands in unequivocal relation to the perception of every department."[4]

It is but a step from Külpe's views if we should find that the intensive relaxation of movement brings with it a subsidence of voluntary recollection and reflection.

Wundt recalls that Fechner observed during attention to an outer stimulus in the sense-organ—for example, in the ears during hearing, or about the eyes during vision—a slight tenseness (*eine leise Spannung*). Assuming that Fechner was right, it would seem logical, if a means might be discovered to relax the tension, that thereupon the attention to the outer stimulus might be diminished or done away with altogether. Such an assumption would harmonize with our results.

It seems unnecessary for the purposes of the present paper to discuss the views of Wundt, beyond recalling in a general

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[3] Italics mine.

[4] *Outlines of Psychology*, translated by E. B. Titchener, 1895, 187. We are warranted in inferring that, according to Külpe, reflection likewise never takes place without the assistance of movements, for later he adds: "Reflection, psychologically considered, is nothing else than a more or less complicated series of reproductions, associatively originated, and possibly abbreviated by the exclusion of intermediary terms" (446). It need not concern us here that later experiments in Külpe's laboratory disclosed to him that in reflection there may be, in addition to reproductions, certain unanalyzed mental elements; for even if reflection does not take place without these more recently discovered elements, it is nevertheless beyond question that reproductions themselves are a *sine qua non* of reflection, according to Külpe; and voluntary reproduction, he observed, never takes place without the assistance of movement.

way that he maintained that feelings of strain and relaxation are always connected with the processes of attention.[5]

A familiar quotation from Binet also comes to mind at this point:

> "It is enough to remember that all our perceptions, and in particular the important ones, those of sight and touch, contain as integral elements the movements of our eyes and limbs; and that, if movement is ever an essential factor in our really seeing an object, it must be an equally essential factor when we see the same object in imagination (Ribot)."[6]

The well-known observations of Lange and James also will be recalled in connection with the present work. James, for instance, believed that, if in fancy we abstract all bodily symptoms from a strong emotion, there is nothing left behind. First among such symptoms he named "rigidity or relaxation of this or that muscle." However, he lacked an experimental method to test his beliefs. Had it occurred to him to try out the effect of intensive relaxation on the emotions, he would have come upon the method presently to be described.

In the same vein writes Washburn in her book on "Movement and Mental Imagery". In advancing her motor theory, she discusses associations such as occur with a series of nonsense syllables or when a man is about to write a cheque, and she makes what she calls "a crucial assumption for her whole hypothesis,—that there probably are, going on in the muscles, light actual contractions."[7] This theory is similar to the views of Watson and others that thinking is essentially a play of muscles.[8]

Such assumptions as those of Washburn and Watson are theoretical. In the work to be described, the question is investigated whether thinking may take place where there is extreme muscular relaxation. It is not the present purpose to demonstrate any particular theory of consciousness or of be-

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[5] W. Wundt, *Outlines of Psychology*, trans. by C. H. Judd, 1907, 92. Wundt points out that there may be grades of consciousness. Our subjects and patients do not use these terms, but their observations are to the same effect. "Sowohl die psychischen wie die physischen Bedingungen des Bewusstseins weisen uns demnach hin, dass das Gebiet des bewussten Lebens mannigfache Grade umfassen kann. In der That finden wir schon in uns selbst je nach äussern and inneren Bedingungen wechselnde Grade der Bewusstheit, und auf ännliche bleibende Unterschiede lässt die Beobachtung anderer Wesen schliessen. In allen diesen Fällen gilt aber die Fähigkeit der Verbindung psychischer Inhalte als Massstab des Grades der Bewusstheit. Sobald wir Eindrücke nur mangelhaft in den Zusammenhang unserer Vorstellungen einreichen oder uns ihrer später wegen dieses mangelhaften Zusammenhangs nur unvollkommen erinnern können, schreiben wir uns während der betreffenden Zeit einen geringeren Grad des Bewusstseins zu" (*Grundzüge der phys. Psy.*, 3, 1903, 324).

[6] Quoted from W. James, *Prin. of Psych.*, 2, 1907, 61.

[7] M. F. Washburn, *Movement and Mental Imagery*, 1916, 32.

[8] J. B. Watson, *Psychology from the Standpoint of a Behaviorist*, 1910, 15.

havior, but rather to submit a set of observations, which each school of thought may assimilate as may seem fit. Furthermore, it seems unnecessary to enter upon a complete discussion of motor activities and conscious processes, for the conclusions that we shall draw will rest upon our observations, rather than upon previous theories.

The Technique of Progressive Relaxation

Since a detailed description of method has recently been published, only a summary will be here repeated.[9] Needless to say, the method is best learned by the experimenter in person, rather than from a written account.[10] In this respect it is evidently like any other concrete laboratory or clinical method.

The individual is to learn how to relax the principal muscle-groups of his body to any extreme degree. Obviously this implies the reduction of impulses along motor and associated portions of the nervous system, since it is generally agreed among physiologists that there are no specific inhibitory fibers to the striated muscles.

The relaxation is progressive in three respects. (1) The *S* relaxes a group, for instance, the flexors of the right forearm, further and further each minute. (2) He becomes acquainted in a certain order with the principal muscle-groups of his entire body. With each new group he simultaneously relaxes such parts as have previously received practice. (3) As he practises from day to day, he progresses toward a habit of repose. He tends toward a state in which quiet is automatically maintained. This is not to be confused with what has hitherto been known as relaxation or what is popularly called relaxation. For when the unpractised person lies as quietly as he can on a couch, close observation of external signs shows that the relaxation is incomplete. There remains what may be termed *residual tension*. The same may also be inwardly observed, through kinaesthetic sense. Doing away with residual tension is the essential point of the present method. This may not happen in a moment, even in the practised person. Residual tension only gradually disappears; it may take 15 min. progressively to relax a single part, such as the right arm. The desired relaxation begins only at the moment when the individual might appear to an inexperienced observer very well relaxed.

Progressive relaxation is called "general" when the individual lies with closed eyes and relaxes all over. It is called "relative" when he is active, but is relaxed so far as possible during that activity: for instance, the individual sits in a chair and relaxes as far as possible in this posture; or again, he converses, but relaxes so far as he may while doing so. The relaxation is not carried so far that it interferes with the activity of conversing, but those muscles whose activity is not necessary for the action are relaxed, and also a partial relaxation of the muscles in use is secured. A third form of progressive relaxation is "specific relaxation", to be described later. Our present account will deal chiefly with general relaxation.

The individual to be generally relaxed lies upon a couch in a quiet room with eyes closed. If the *E* is relaxing several individuals at a time, he proceeds noiselessly from room to room. This was done at the Univer-

[9] *Journal of Nerv. and Men. Dis.*, 1924.

[10] To coöperate with laboratory investigators desiring to repeat the present observations, preliminary instruction may be furnished in Chicago.

sity of Chicago, where at each session 4 to 8 *S*s practised simultaneously. In laboratory work the period lasts from 1 to 1.5 hr. From time to time during the hour the *E* notes on his record all the instructions that have been given and whatever observations have been made. Therefore it is important to have some form of ready record sheet.

Initial Instructions

The initial instructions given in 1923 at the University of Chicago were as follows: the individual was simply instructed that he was to learn to relax to an extreme degree. Therefore it was useful first to show him what it is to be tense. Lying down with eyes closed, he flexed the right or left forearm, while the *E* held it back in order to make the contraction more marked. The individual then reported whether he noted the sensation of tenseness and where. When successful, he was informed that this experience was by mutual agreement to be called "tenseness."[11] Whenever this same sensation or experience appears in this or other parts of the body, it is to be called "tenseness."[12] As the *S* contracts the part, it is said to him, "This is you doing! What we wish is the reverse of this,—simply not doing." It is of the greatest importance to inform the *S* that he is to make no effort to relax, for, as he finds, making an effort is being tense, and therefore is not to relax.[13]

Since the stimulation of discussion is to be avoided, few words pass between the *E* and the *S*. From time to time, when the director returns to the room, instructions are given as tersely as possible. Never telling the *S* suggestively what is happening or what will happen, the director avoids the use of suggestion. For instance, it is not said, "Now your arm is becoming limp!" or "Your arm will become limp!" Our experience shows that the presence of the director often proves disquieting, and that it is necessary to tell the *S* not to bother about the other's coming and going, but just to keep on relaxing, or to relax all the more when disturbed in this or any other manner.

The Cultivation of the Muscle Sense

As an aid to the individual in relaxing, we have cultivated the muscle-sense.[14] When a muscle-group first receives practice,

[11]No distinction will be drawn in the present paper between the sensation and the image of muscular contraction. Either will be called "tenseness", or "the experience of muscular contraction."

[12]The well-known "stimulus error" is of course avoided in all of the present work. The *S* is trained to report whether or not he notes the presence of a certain sensation. This sensation was studied by R. S. Woodworth in his work *Le Mouvement*, 1903. The *S* is not at any time asked, "Is your muscle contracting?" but only, "Do you perceive the sensation?"

[13]This is one of the most delicate points of the entire technique. It is quite similar to learning any other physical art, such as billiards or dancing. Here, also, effort spoils the result, which must be secured in a relatively relaxed fashion.

[14]The sensation from muscular contraction is described by our *S*s as a rule as dull or faint, readily obscured by other experiences, fairly localized,

the *S* contracts it, and then reports his experience.

On the *S*'s record sheet, + means a positive report with successful localization, − means failure, some number represents the number of reports, S indicates that he reported spontaneously with no hint from the *E*, while I indicates that the location of the contraction was pointed out to him.

The method used to cultivate the muscle-sense, so that faint tensions are recognized and correctly localized, has been previously described. The trained individual, as compared with the beginner, appears to have a much increased awareness of his sensations of muscular contraction and their locality. During activity as well as partial relaxation, he knows where he is tense, in a kaleidoscopic way, and his reports can be checked with objective observation.

The Objective Estimation of Contraction and Relaxation

This has been previously discussed. It includes palpation, passive motion, observation of respiration, of apparent flaccidity, of absence of movement or contraction, graphic records, X-ray films, the characteristic vacuous appearance of face and open eyes when relaxed, and other tests. Further work in this respect will soon be published.

Sample Records

It seems sufficient here to summarize two records, since they are typical of practically all of the others who learned to relax well.

S P. W. There were 16 periods of about 1.25 hr. each, beginning Jan. 8 and ending Feb. 16, 1923. He stated that he had a little knowledge of anatomy. On the first day the initial instruction was given and practice was devoted to the left biceps alone. At first he failed to note tenseness there even when instructed, but finally succeeded −2 +1 I. Although he became fairly quiet for a beginning, the eyelids winked frequently. At the second period, all the muscle-groups of the arms were covered. He noted tenseness in the left arm and the right biceps + 1 I, but toward the end of the hour succeeded upon the first attempt spontaneously with other groups. On one occasion when the *E* entered the room it became obvious that *S* did not really know what was desired, for he lay upon the couch with eyes open. Thereupon the directions were given *first to make the whole arm stiff, but without flexion or extension; next to let go a little, then on and on, past the point where it seemed to him fully relaxed.* At the third period the muscle-groups of the legs were covered, and in some cases he succeeded in recognizing tenseness +1 S. He lay fairly quiet and did not commit the error of opening his eyes. Upon arising at the end of the period, he appeared somewhat drowsy. The fourth period was devoted to the trunk and shoulders. He noted tenseness +1 S, upon drawing in the muscle-groups of the abdomen; similarly in the intercostal muscles upon inspiration, and

but diffuse and ill-outlined, neither agreeable nor disagreeable, but particularly indistinct and characterless. It is to be distinguished from other somatic sensations, due to touch, warmth, cold, tickle, and pain. These distinctions are familiar to the student who has had the average elementary course in experimental psychology.

in the *erector spinae* upon bending the trunk backwards. When the arms are drawn forward, the pectoral muscles come into play. This was noted −1 +1 S. Upon drawing the shoulders backwards, he noted tension posteriorly −2 +1 S. Shrugging the shoulders is one of the tests for ability to localize tenseness, for the average *S* does not know that the muscles for this act are partly in the neck. Upon shrugging, the present *S* noted tenseness −1 S+1 I. The fifth period was devoted to the neck, for he usually lay with his head held stiffly. He was instructed, "Let all parts go as limply as a rag! When they become so, then whatever you have done up to that point, continue on and on!" Later, when he still held his neck stiffly, it was said to him, "Let the head go just like a rubber ball!" At the sixth period he was directed to wrinkle and frown, and noted both +1 S. For the first time he now began to appear relaxed. When the *E* raised the arms, they fell limply.

The next three periods were devoted chiefly to the eyes. Since this stage is important, it will be described in detail. The *S* lies with eyes closed, and is instructed to close the lids still more tightly, when the usual question is asked, "What took place?" As a rule the correct reply is made that tenseness is felt in the eyelids. Next, with eyes still closed, he looks to the right and then reports. If he mentions a feeling of "tenseness or muscular movement here," indicating the eyeball, it is recorded +1 S. This is repeated looking to the left, then up, then down. Later the instruction is given, 'Just to let the eyes go, not to bother to look in any direction'. The director notes the degree of success by the flaccidity and absence of winking of the closed eyelids. After practice at relaxing the eyes in this way has continued for perhaps 30 min., it is interrupted and the eyes are opened for the next task. Standing at the foot of the couch about 6 feet away from the eyes, the director holds his index fingers on a level but about 3 ft. apart. After looking from finger to finger horizontally from side to side, the *S* is desired to report what happened.[15] If he reports muscular sensation of eye-movement, the fingers are neared to about one-half of the former distance, when the *S* repeats the movement and the observation. This is later done with the fingers held about half an inch apart. Next a single finger is held up while the *S* looks at it for a moment or longer. The report is recorded + 1S if, for instance, he reports that he saw the finger and notes tenseness in the eyeballs as in convergence. Next the fingers are held one above the other and the *S*'s eyes move vertically from finger to finger through the 3 distances. Finally the lone finger is again held up. After each test the *S* reports. At this point it is convenient to give the *S* an example of relaxing the eyes. The director sits with eyes open, where he can readily be seen by the *S*, and lets the eyes relax so that they appear not to be looking. The forehead and brows must also be so relaxed, and the rest of the body, so far as possible, in order to give a clear illustration. The *S* may describe the appearance of the director as empty and expressionless. P. W.'s relaxation of his open eyes was visibly improved after he had witnessed the example.

With the seventh period, work was begun with imagery. The *S* is not told what he is to look for, but lies with eyes closed, and is directed to look in imagination from finger to finger held wide apart, from side to side. As

[15] It must be emphasized that care is taken to avoid influencing the *S*'s observations. He is to give a general report of what took place at a specified moment. Not alone do his accounts often mention elements other than tenseness, but in the advanced work he is not even directed to look for tenseness. For this reason, the *S* may fail upon the first exercise of a part to mention tenseness either as present or absent. Precaution is of particular importance in the work on imagery to be described in the following pages. Throughout the work leading questions are to be shunned, but spontaneous observation is to be cultivated.

a rule, when this is done, the eyeballs can be seen to move a little beneath the closed lids from side to side. Furthermore, observations by many experienced patients and *S*s have concurred that there is a feeling of tenseness in the muscles of the eyeballs, quite similar to that when the movement is made with open eyes, save that it is less intense. Accordingly if the *S* reports a feeling of tenseness or muscular movement, the record is +1 S. This was true in the present case. Leading questions at this stage are particularly to be avoided. The same results were had with imagining the fingers at the middle distance and at the smallest distance apart. From our experience it appears that the tenseness which is momentarily present when the stationary finger is imaged is more difficult to note than that when looking in imagination from finger to finger. At first P. W. was doubtful about it, but finally reported it present. Following such practice with ocular tensions, the *S* who is progressing with the method will lie generally limp, and the eyelids will be strikingly relaxed, without winking. As a rule, he who has been most apt in recognizing slight tension, is soonest to reach this stage. The next step requires greater delicacy of observation than any of the preceding.

The *S* still lies with eyes closed. The instruction is tersely given: "Imagine a motor-car passing." In the present instance the *S* simply reported that he had no definite experience. The director avoids comment, so as to give no leading questions. The *S* was again requested to imagine a motor-car passing, and thereafter to say what happened. Now he reported a very hazy visual image of a motor-car moving, along with a feeling of tenseness in the muscles of the eyeballs. The instruction to imagine 'a man passing,' and later 'a flower fluttering in the wind' also brought the report of very hazy visual images with slight tenseness in the eyeballs. Following this, a period of about 15 min. of ocular and general relaxation was given. The next task was, "Imagine a bird flying in the sky." P. W. reported "No experience." Upon repetition he reported a vague visual image with slight tenseness in the eyeballs. "Eiffel Tower in Paris" brought the report of a more distant visual image, along with slight ocular tenseness. Imagining 'a tree in the distance' gave similar results.

The ninth period began with a review of imagining a "motor-car passing." P. W. reported that he did not see the car, that he had no experience. "A man passing" brought the report of a visual image of a man with a slight tenseness of eyes moving to the left. Instructions to think of 'a blade of grass' and 'a bird in the sky' brought similar accounts. The question was here asked, "What happens when you relax your eyes?" He replied, "There is no tension, no strain, but a tendency to go to sleep." "What else?" He was silent and the question was postponed, to be repeated later.

The *S* was next successively requested to report about what happened in each of the following acts: smiling, pouting, protruding the tongue, retracting the tongue, closing the jaw tightly. In each of these instances he reported tenseness in the correct place. A correct report, following protruding of the tongue, is one of the tests whether a *S* is really succeeding in localizing tenseness, for otherwise the *S* (who does not know anatomy) is not likely to report tenseness both in the tongue and in the floor of the mouth.

At the tenth period, P. W. was instructed to count to ten, whereupon he reported tenseness of the tongue and lips, jaw and larynx. Instructed to whisper from one to ten, he made the same observations, except that the tensions were not so marked. All this was with eyes closed. Upon whispering half as loudly as before, there were analogous results. He whispered so that the director could just notice the slightest movement of the tongue and lips. This brought similar reports, save that the tenseness was much diminished. The next request was to repeat the act, but so faintly that it could not possibly be seen. He now reported that the feeling of tension in

the tongue, lips and larynx was still present, although very faint. He was requested to repeat the act, but very much more feebly still. He stated that he was able to note this tension only in the larynx and tongue. Following this, the usual instruction to relax was given, including the eyes and tongue and larynx and the like.

The next exercises were with auditory imagery. Entering with no previous announcement, the *E* tapped repeatedly but lightly with a pen on the table to the right, and then asked if the *S* could report what happened. Reply was made that the eyes moved toward the sound. Tapping in front and to the left of the *S* brought the same reply. In some of these instances it was possible for the director to observe the eyes move under the closed eyelids. Following this, the *S* was asked to imagine the sound of tapping. He reported that he had a similar but less intense experience, auditory images with tenseness as from ocular movement. Instructed to imagine the sound of a motor-car on the Midway, he later reported that he had seen the car, with no auditory image, but with slight ocular tension. He was instructed to imagine the sound of a horn in the distance, but replied that he failed to image it. Upon the direction to imagine a running faucet, he reported the image of a groaning sound with a feeling of tension in the ear-drum, as well as a visual image of a faucet with a faint tension in the eyeball. Requested to imagine the voice of a certain university instructor, he replied that he heard the pecular sound of the voice and saw the class room, but reported no tension. After again imagining the sound of that instructor's voice, he corrected his previous report, saying that there was slight tension in the eyes.

At the eleventh period, during attempted relaxation, the *S* still held his head a little stiffly. To make him aware of this, his head was pushed to the side, and he was urged to let it go a little more. After this had been done, he was requested in turn to imagine the following things: a motor car passing; a man passing; 13 times 14. In each case he reported visual images with tension in the muscles of the eyeballs. Next he was requested to think of the relation of interest to knowledge. He reported visual images of the terms and feelings of tenseness in the eyes, but no thought of the relationship. The questions were asked, "What is mean deviation?" "What is the relation of idealism to monism?" "What is probability?" Reports on these complex experiences were evidently beyond the capacity of this *S*. He waited long before replying, and evidently could not report further than to say, "Tension in the vocal apparatus". He was instructed to relax completely, including the vocal apparatus. At the twelfth period his neck was found still a little stiff. The director moved it, and P. W. was instructed to practise letting it go completely. He was asked whether the eyes relaxed completely? He replied that they did so occasionally. He was then instructed to "let go till there is not the faintest trace of tension."

At the thirteenth period the *S*'s arms appeared extremely limp. Without any leading question he was asked, "What happens when you relax your eyes completely?" He reported that relaxation seems general and complete for a brief period during which no thought at all is present; that 'thoughts occasionally slip by' during the intervals when he is not so relaxed; that with complete relaxation of the vocal apparatus there is no inner speech; while with complete relaxation of the eyes, along with general relaxation, there is no attention to sound. In short, with the approach of general complete relaxation, all imagery ceases.

The remaining periods were devoted to permitting the *S* unaided to perfect his technique, letting go further and further, and increasing if possible the period of complete relaxation.

At the fourteenth period or later he reported that the times during which no imagery was present were increasing in length. He failed to go to sleep during the periods. At the final meeting, the director noted that

he appeared well relaxed, but not to the utmost. The eyelids did not have the perfectly "ironed out" appearance that distinguishes complete relaxation in the most successful *S*s.

S B., graduate in psychology, was present at about 20 periods, ending March 7, 1922. From the outset as a rule tenseness was recorded +1 S. Likewise at each stage her relaxation was relatively excellent. She practised considerably at home, but was somewhat late in learning to distinguish between strain and tenseness. When the arms were extended forward, contracting the pectoral group, she stated that she felt tenseness behind and strain in front. The method of correcting this error is to have the *S* relax, while the director pulls the limp arm forward, thus putting strain in the interscapular area. In the present instance, the *S* then spontaneously noted that this sensation was not the same as tenseness. Apparently her localizing sense was developing, for upon shrugging the shoulders she localized the tenseness +1 S, and similarly with movements of the eyes, open and closed.

Her observations on visual imagination were clear-cut. Upon staring at the finger in imagination, she reported, "A slight feeling of contraction, not so much as when open, along with a visual image of the finger." Requested to imagine a man moving from right to left, she spoke of a visual image, along with a sensation from ocular movement left to right. Imagining 'a motor car passing;' 'a boat passing on the lake;' 'a street-car moving;' 'a man standing still,' brought reports of visual images, with sensations as from contractions of the ocular muscles. Her first account of imagining the Eiffel Tower in Paris was of a visual image, "but no contraction, for I can see it so far off." "A man very far off" brought the report, "I hardly can describe it. There is not quite the same contraction as before; so slight that I can scarcely think of it as contracting." Repetitions with Eiffel Tower brought the report she felt sure she did not note contraction in this case.

When a *S* fails to note tenseness, which the director suspects, the latter must carefully avoid prejudicing the *S*'s judgment, for observation should be spontaneous. After such failure, it is generally better to have a period of general relaxation, and then to return to the exercises. Accordingly the *S* relaxed at this point, and reported that she almost slept. At first there were many visual images, but they gradually went away as she became quieter. She would feel a contraction and would try to get rid of it. Contraction of the eyes and the frown often left together. She added that on the previous occasion she had found that visual imagery interfered with relaxation, for "the eyes shot around towards the things that were thought of". Imagining 'a ball falling' brought the report, "Downward motion of the eyes, with visual image of the ball." Imagining 'a blade of grass' brought a similar account. However, upon imagining 'a green ball in the distance,' she noted a visual image with practically no contraction.

While the *S* was an excellent observer, she still remained doubtful whether tenseness is present in imagining *distant* visual objects. Accordingly she was requested to imagine the green ball again in the distance, but off to the left. A visual image was noted, but this time along with a sensation of slight contraction; similarly when off to the right. Upon imagining it in the center of the field, she observed the image of the ball with a very faint contraction. Images of Eiffel Tower off to the right, and then to the left, seemed to be accompanied with slight contraction, as in the eyes. She said that the contraction seemed less than in the case of the ball, for the tower was further off. When the tower was imaged in the center of the field, she found it difficult to say whether tenseness was present. At the next period she reported that during successful relaxation, visual imagery disappeared. She said that she seemed more likely to go to sleep when the eyes relaxed. During the period she slept. Review was given of looking

from finger to finger with eyes open, and later again in imagination. Further practice was had in imagining a rubber ball about 10 ft. away, and a building in the distance. In each case she noted a visual image, with a very slight contraction. Later she was requested to imagine London Bridge and reported a visual image, but practically no contraction, or at least so little that she remained in doubt. At this stage she was not sure but that there was some contraction, which she believed she ought to call the faintest contraction that she could distinguish. She was now requested to imagine London Bridge, but at the same time to relax completely and to see if 'the visual image' remained or left. She found that under these conditions, with advancing relaxation, the visual image disappeared. The same took place with the image of Eiffel Tower. She finally observed very slight muscular tensions present upon imagining even very distant objects.[16]

The period of Feb. 15 was given to involuntary visual images. The instruction was, "Do not seek any visual images, but if any should come, report!" She observed as follows: "First an image of the director, accompanied by a slight contraction of the ocular muscles. Second, a vague visual image of dropping water with very slight contraction of the eye muscles. Third, an image of a scene out of the window, along with slight contraction. Fourth, the lake at Jackson Park, with almost no contraction. Fifth, a certain motor-car, with very slight contraction." She said that at the time the director came into the room there were no visual images, and her eyes seemed perfectly relaxed. Periods from Feb. 15 to 21 were given largely to the face, lips, tongue and speech, with success usually +1 S. On Feb. 21 the question was asked, "What takes place when you relax fully?" She replied, "I lose visual and vocal imagery." "What do you have left?" "Nothing. As a rule I go to sleep."

The period of March 7 was devoted to observation with eyes open. She was instructed to relax her eyes, and to imagine a man walking by. She reported that the eyes did not stay relaxed! They tended to move in the direction the man was walking. Instructed to imagine a motionless motor-car, she reported a very slight downward tendency of eye-movements. 'The motor-car was seen out there' (indicating). Imagining a tree in the distance brought the report, "There was no perceptible motion. The eyes seemed, however, as if held still, with a slight tenseness." The next task was to report when anything occurred spontaneously to the visual imagination. Her statement was that when her attention went to any visualized object, the eyes seemed to tend to focus there. She added that as a rule, when her eyes are open, she does not have visual images spontaneously. Requested to imagine a certain graduate student, she reported a slight tendency towards convergence along with a visual image of the individual in front of her. When she imagined a person walking upstairs she noted a slight tendency to move the eyes up. She visualized a man walking by, whistling, and reported with it a slight tendency to move her eyes towards the side in which he was going. She summarized her observations by saying that when visual images appeared, there was a slight tendency away from relaxation and towards convergence. This was more noticeable when she was instructed to have a visual image than when the image came spontaneously. She found the tenseness also more noticeable if the visual image was projected than if it was not.

In summary, this *S* learned to relax excellently. She found that imagery, visual and vocal, both voluntary and involuntary, was accompanied with sensations of tenseness. This was true of visual imagery with

[16]In distant vision, as is well known, the ocular muscles are relaxed, in the ordinary sense of the word. If this observer is correct in her report that slight tenseness was present during visual imagination of distant objects, this may perhaps be due to slight shifting of focus during that act, or to the tendency to visualize the objects out of the central line of vision.

the eyes both closed and open. Most difficult of all to note was the faint tenseness present upon visually imagining an object in the distance. Visual and other images disappeared upon progressive relaxation of the corresponding tension.

Discussion

The above records are, for the interests of the present discussion, typical of all the other *S*s or patients who learned to relax very well. Four *S*s are not considered further, since one failed to attend, another did not seem earnest in following instructions, the third was evidently in too excited a condition to make the necessary progress in the required time, while the fourth failed to attain the control of muscular relaxation and the finer skill in observation that was desired. This leaves 11 laboratory *S*s and 10 highly experienced patients who attained the requisite skill and who agreed in their observations in connection with imagery.[17]

The earliest observations of each *S*, of course, may not be counted. *It is repetition that makes the sensation of muscular contraction easy to observe.* At first the individual who contracts his biceps may scarcely be confident of the sensation he gets from this large muscle; but with experience it becomes easy. A more advanced task is to recognize the muscular sensation from a slight movement or from slight convergence of the eyes. Here again practice improves, until the experienced *S* reports the tenseness every time. When the stage of visual imagery is reached, the *S* may here also at first fail to report the experience of muscular tenseness.[18] However, with repetition of the imagery, every *S* finally reported the tenseness in a spontaneous way.

Our conclusions must be subject to certain reservations. (1) The agreement of our *O*s that the experience of muscular contraction accompanies imagery does not permit us to infer that physiological contraction takes place, unless there is additional evidence by objective methods. Further investigations from the objective point of view are under way. (2) There is a possibility of error on the part of our *O*s. For they may

[17]Seven of the laboratory *S*s seemed to have clear visual imagery and were of the visual-motor type. Four, including P. W., were less clear in their visual images, inclining more to the motor type. One of these at first seemed lacking in visual imagery, but later reported some very faint forms.

[18]It must be remembered that the director, according to the methods of the experiment, does not ask the direct question, "Did you note tenseness?" but only requires the *S* to report what happened. There seem to be four sources of omission with the inexperienced *S*. (1) Omission through lack of training. The *S* admits that he does not know how to recognize the sensation of tenseness. (2) The visual image is observed, but the attendant fainter tenseness is ignored. (3) The *S* wrongly identifies tenseness with movement, and fails to report tensions in convergence. (4) Tenseness is observed, but not reported; error of the incomplete report.

conceivably have developed a prejudice or habit of reporting tenseness. However, it does not seem likely that there was such error. (*a*) Our *O*s were mostly of a critical type of mind. (*b*) The investigator took precautions to avoid leading questions or hints, and the *O* did not know what matter was under investigation. (*c*) The *S*s who have shown the greatest skill in relaxation and in their reports on the locality of contractions do not require the same repetition as the others. Upon the first occasion, they generally report tenseness during imagination. (*d*) *S*s whose technique is still a little lacking in progressive relaxation of slight eye-movements, as externally manifested, do not report that imagery has vanished. (*e*) Every skilled *S* was requested to relax progressively, but at the same time to have visual images. Some reported failure with chagrin, and tried it over again. Every one found the combination impossible. (*f*) We attempted to rule out the error in question by using a relatively large number of *O*s, independent of each other, covering a period of years. Their observations agreed.

There seem to be additional grounds for believing that the experience of contraction accompanies imagery. The profoundly relaxed individual has a characteristic appearance, as described below; does not look or act like an imaging or thinking person; later reports that he was not mentally active; gives no evidence of the results of thought-processes; and often goes to sleep.

The relaxation of the residual tension of the small muscles of the sense-organs is a delicate matter that requires practice. All *O*s agreed that, when this was done, mental imagery dwindles or ceases in a corresponding way. The face of the individual who is so relaxed makes a lasting impression on the beholder; the eyes, if open, are vacant in appearance; they seem to be "not looking." The whole face is expressionless. One student, watching the director illustrate such relaxation, stated that it looked "as if the individual could not possibly be thinking." The thesis that progressive relaxation brings with it absence of thinking is apparent, literally, on the face of it.

This thesis also harmonizes with the experience of all the *S*s and patients who considered that it was impossible both to be relaxed extremely and to have images at the same time. With the advent of the one condition, the other invariably ceased.

We find, therefore, the experience of muscular tenseness a *sine qua non* of imagery, attention and thought-process. This is not so strange as at first it seems; for everyone will admit that, when a sense-organ, for instance, the eyes, are active, the muscles that control them also are active, and the sensation from the controlling muscles evidently plays a useful rôle in vision. In a corresponding way, it seems a matter of course that when

the original visual experience is repeated, taking the form of imagery, the muscular experience that goes with it also is repeated. In this way the individual doubtless at least in some measure controls his images and thought-processes. The cultivation of this factor has been used in clinical work for the control of undesirable mental activity or overactivity.[19]

Résumé and Conclusions

(1) A method is described to relax the striated musculature in a progressive manner.

(2) The *S* is trained to continue the process of relaxation, or *negative* of contraction, to an extreme degree.

(3) The muscles of the ocular regions and of the speech apparatus receive special, prolonged practice.

(4) The director judges the relaxation of the *S* by certain objective signs.

(5) The *S* judges the relaxation by the absence of the sense of muscular tenseness. Particular training is given with the chief muscle-groups of the entire body in order. Observation of this sense is gradually cultivated, being most difficult to observe in the small muscles of the sense-organs, especially in their slight and fleeting variations.

(6) The *S*s make their observations independently and unknown to each other, in order to avoid prejudice.

(7) For the same reason, the director carefully avoids suggesting to the *S* what he is to look for. The *S* did not know in advance that we were investigating whether imagery diminishes with advancing relaxation of muscles. The only instruction given was to relax certain muscles and to report.

(8) All the *S*s and patients who attained high skill in progressive relaxation spontaneously arrived at, and agreed in, their conclusions regarding psychological activities. With visual imagery there is a sense as from tenseness in the muscles of the ocular region. Without such faint tenseness, the image fails to appear. With complete ocular relaxation, the image disappears. This may be done by individuals of greatest skill and experience not alone lying down, but also sitting up with eyes open.

Motor or kinaesthetic imagery likewise may be relaxed away. "Inner speech," for instance, ceases with progressive relaxation of the muscles of the lips, tongue, larynx and throat.

Auditory imagery also is attended by a sense of tenseness, sometimes perhaps felt in the auditory apparatus, but character-

[19]The writer is not arguing in favor of a motor theory of consciousness, and particularly not in favor of Münsterberg's highly speculative views. This paper is an attempt to present our observations and our results.

istically in the ocular muscles. The individual tends to look toward the imaged source of sound. With the relaxation of such looking or other tension, the auditory image is absent.

Progressive relaxation is not as a rule perfect or complete save perhaps for brief periods of time. It is during such brief periods that imagery seems altogether absent. However, when the relaxation of the muscles of the sense-organs seems to approach completeness, there takes place the diminution of image-processes. It appears that natural sleep ensues after the imageless state is maintained for a relatively prolonged time.

With progressive muscular relaxation, not alone imagery, but also attention, recollection, thought-processes, and emotion gradually diminish.

Relaxation apparently is a natural physiological function which every individual possesses and uses, for muscles that contract must also relax. It is shown in the present work that this function may be cultivated to the point of a fine control. In our experience it may be cultivated to some extent at least with every normal individual, just as every normal individual may learn to walk; but persons vary greatly in the time required for learning. In general, the person who is highly suggestible may be slower to learn than one who is independent and observing.[18]

[18]A future paper with a different approach will present further evidence. I am indebted to Professors H. A. Carr and A. J. Carlson for critical reading of the text.

A COMPARISON OF SOPHISTICATED AND NAIVE SUBJECTS BY THE ASSOCIATION-REACTION METHOD[1]

By Dorritt Stumberg

I. Statement of Problem and Method

The purpose of the work here reported is to compare the result of the association method of detecting suppressed ideas, when used with subjects who are thoroughly familiar with the method both in theory and in practice, with the result of the same method when applied to persons who are unfamiliar with the method. In most of the work reported in the literature the subjects are either entirely naive so far as the knowledge of the method is concerned, or they have heard discussions in the classroom and have perhaps acted as subjects once or twice before the principal experiment. In the present study the subjects served again and again and thus had opportunity to improve their technique of preventing detection.

The *S*s were three students of Harvard University and two students of Radcliffe College, all of whom were familiar with the method before the present experiment started. These *S*s are designated as the sophisticated group. To make sure they had the method fresh in mind they were asked to read pp. 112-116 in "An Elementary Laboratory Course in Psychology" by Langfeld and Allport, in which there is a brief description of the method and a list of factors upon which may be based judgments of guilt or innocence. Furthermore, the *E* pointed out to them certain methods by which a guilty person might appear innocent: (1) deliberately lengthening the reaction-time to non-crucial words (in order to equalize the averages of the reaction-times to crucial and non-crucial words, and to prevent the longest reaction from occurring with a crucial word); (2) anticipating test-words and thinking up noncommittal replies, so that when the test is given there may be no lengthening of the time due to a consciousness of guilt; and (3) feigning surprise at unusual words with which they must be familiar if they were "guilty."

There was a preliminary series in which the *S* was given two stories, one of which he was instructed to read. Immediately after he had read the story, he was given a series of 25 stimulus-words of which half came from one story and half from the other story. The words from the story he had read

[1] From the Harvard Psychological Laboratory. Submitted by H. S. Langfeld.

were "crucial" words to him, and the words from the other story served as non-crucial words. Both the responses and the reaction-times, taken with a stop-watch, were recorded.

After the preliminary series, in which three trials were made, the *S* was again given two stories, but the list used in making this test contained 50 words, 25 pertaining to one story and the other 25 to the other story. The *S* was instructed to make the *E* think he had read the story which actually he had not read. After this method had been tried twice (tests A and B), with an interval of a week between trials, the *S* was given one story and told to read it or not to read it as he chose, but in any case to make the *E* think that he had not read it. This test was tried three times with each *S* (tests C, D, and E) at intervals of about a week, making a total of 5 tests for each *S* after the preliminary trials.

Test C was repeated with four entirely naive *S*s. The method was the same as the one used with the sophisticated *S*s, except that no suggestions were given as to the nature of the test or the means of avoiding detection. Test D was repeated with one naive *S* and with one *S* who had studied the test several years before, but who did not realize the method was to be used until it was well under way. This *S* did not, therefore, have an opportunity to prepare a defense, though she did presumably have an advantage over the entirely naive *S*s. Test E was repeated with one naive *S*.

In making the list of words the *E* tried to avoid unusual words and others, such as foreign words, which she thought would result in a long reaction on the part of either a guilty or an innocent *S*.

II. Explanation of the Table

The results are presented in the Table. The first vertical column gives numbers for convenience in reference to the Table. The numbers 1 to 6 refer to different criteria used in making a judgment as to guilt or innocence. The small letters indicate that there was an attempt to increase the accuracy of judgment by setting an arbitrary standard for each criterion.

The second column gives the different criteria used as a basis for judgment of guilt or innocence, and in some cases the arbitrary limitation of these criteria.

The third column gives the results for sophisticated *S*s. The numbers show in how many cases the criterion mentioned in the second column is present. The positive sign shows that the criterion was a correct indication of guilt or innocence. The negative sign shows that the criterion was an incorrect indication of guilt or innocence.

The fourth column gives the results for the naive *S*s.

TABLE

		Number of correct and incorrect judgments		Percentage of correct judgments			Diagnostic certainty		
		Sophisticated *Ss* 23 Experiments	Naive *Ss* 7 Experiments	Sophisticated *Ss*	Naive *Ss*	Ratio of Naive to Sophisticated	Sophisticated *Ss*	Naive *Ss*	Ratio of Naive to Sophisticated
1	Difference between average reaction-times	+14 −9	+6 −1	61	86	1.41	.22	.72	3.3
1a	Crucial difference .2 sec. or larger for a judgment of guilty	+ 7 −7	+5 −1	50	83	1.66	0	.66	∞
2	Difference between A.D.	+ 9−14	+6 −1	39	86	2.20	.22*	.72	(3.3)
3	Longest reaction-time	+13 −8	+4 −3	62	57	.92	.24	.14	.58
3a	Two or more reaction-times in one set longer than the longest in the other set	+ 8 −5	0 0	62			.24		
3b	Difference between the longest reaction-time of one set and the longest of the other set is 1 sec. or more	+ 6 −6	+1 −2	50			0		
3c	Difference between the longest reaction-time of one set and the longest of the other set is 4 sec. or more	+ 5 −1	0 0	83			.66		
4	Associations apparently based upon the story	+ 7 −3	+1 −2	70			.40		
4a	Two or more associations based upon the story	+ 3 −2	+1 0	60			.20		
5	Misunderstanding of word	+10−11	+2 −3	48	40	.83	.04*	.20*	5
5a	Misunderstanding of two or more words	+ 5 −6	+2 −3	45	40	.89	.10*	.20*	2
6	Apparent refusal to give association	+ 2 −3	0 −1	40			.20*		

* By reversal of criterion

The fifth column shows the percent. of correct judgments for the sophisticated *Ss*. The sixth column shows the percent. of correct judgments for the naive *Ss*. These values are based upon the number of judgments which can be made and not upon the total number of experiments. There are some instances in which the value of the criterion which was used was the same for both series. Therefore no judgment could be made. These instances were omitted from the number of cases upon which the percentage was calculated. If they had been included, the value would be smaller in every case.

The seventh column gives the ratio of the correct judgments for the naive *Ss* to the correct judgments for the sophisticated *Ss*.

In the last section of the Table (columns 8, 9 and 10), the diagnostic certainty is presented. 100% correct judgments may be considered certainty. 50% is mere chance. Then 0% is also certainty if one reverses the criterion. The results were therefore treated so that 50% of correct judgments, in column 5, is represented as 0 in column 8; and 100% or 0% in column 5 is represented as 100% in column 8. The cases where the criteria have been reversed are marked with an asterisk. The last column gives the ratio of the diagnostic certainty for naive *Ss* to the diagnostic certainty for sophisticated *Ss*.

Omissions in the Table occur in those instances where there are too few cases for the results to be of value.

III. Discussion of Results

1. *Crucial Differences Between Average Reaction-Times*

If we consider the longer average reaction-time to crucial words an indication of guilt, as has frequently been done in the association test, we shall judge correctly 14 times and incorrectly 9 times, on the basis of this criterion alone. The percent. of judgments which are correct is 61, which gives a diagnostic certainty of .22. Turning to the naive *Ss* we find that we can safely base our judgment on the crucial difference 6 out of 7 times, or in 86% of the cases. This gives a diagnostic certainty of .72[2]. This record was never exceeded throughout

[2] An attempt was made to increase the accuracy of judgments by raising the standards. Two-tenths of a sec. was arbitrarily chosen as the necessary difference between average reaction-times before a judgment was made in tests A and B. In tests C, D, and E, if the average reaction-time to crucial words was .2 sec. (or more) longer than the average reaction-time to non-crucial words, the *S* was considered guilty; if the average reaction-time to non-crucial words was .2 sec. (or more) longer than the average reaction-time to crucial words, or if the difference between the averages of the reaction-times of the two sets was less than .2 sec, the *S* was considered innocent. As the Table shows (1a) this method results in 7 correct and 7 incorrect judgments. The greatest difference which occurs is +.54, but the next greatest is −.5. It is impossible then to increase the accuracy

the entire experiment with any criterion. It is equalled only when we use the A.D. as a criterion to judge naive *S*s. This conclusion is in accord with the results of previous experimenters, who report that the reaction-time is a more reliable indication of guilt or innocence than a qualitative analysis of the reaction-words.[3]

2. *Average Deviation*

If we assume that, when the A.D. is greater for crucial words than for non-crucial words, the *S* is guilty, we shall make 9 correct judgments and 14 incorrect ones. Thirty-nine percent. of the judgments are correct. We may reverse the criterion, saying that the shorter A.D. is an indication of guilt, and thus increase our percentage of correct judgments to 61, which gives a diagnostic value of .22. But in practical application one cannot tell when the criterion should be reversed. When we study the results of the naive *S*s we see that the criterion should not be reversed, for the longer A.D. is a correct indication 6 times and an incorrect indication only once, making the percent. of correct judgments 86 and the diagnostic value .72.

In only one of all the cases is the A.D. a correct indication when the crucial difference between the average reaction-times is not. Here the difference in the A.D. is +.04, and the crucial difference between the average reaction-times is −.13. With a value as small as +.04 a judgment could not be made with any assurance. The A.D. is an incorrect indication 6 times when the crucial difference is correct. These cases occur only for the sophisticated *S*s. Among the naive *S*s the A.D. and crucial differences between reaction-times gives similar results.

3. *Longest Reaction-Times to Individual Words*

The current interpretation of long reactions is that they indicate guilt when occurring with crucial words. From the Table we see that in 13 out of the 23 experiments with sophis-

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of judgments by considering the size of the difference between the average reaction-times.

In considering the longest reaction-time, an attempt to increase the accuracy of judgment is made (*a*) by considering only those cases where one set of words has at least two reactions longer than any reaction-time in the other set; (*b*) by considering only those cases where the difference between the longest reaction-time of one set and the longest reaction-time of the other set is at least 1 sec.; (*c*) by considering only those cases where the difference between the longest reaction-time of one set and the longest reaction-time of the other set is at least 4 sec. See Table, 3*a*, 3*b*, and 3*c*. The results of attempting to increase the accuracy when using other criteria are shown in 4*a* and 5*a* of the Table. These results have a negative value similar to the results discussed in the foregoing paragraph.

[3] H. S. Langfeld, Psychophysical Symptoms of Deception, *Jour. Abn. Psych.*, 15, 325. H. M. Leach and M. F. Washburn, Some Tests by the Association Method of Mental Diagnosis, this JOURNAL, 21, 1910, 162.

ticated *S*s the longest reaction-time is a correct indication. Eight times we are wrong when we judge on this basis, and twice we cannot judge because the longest reaction-times in the two sets are equal. The percentage of correct judgments is 62 and the diagnostic certainty is .24. With the naive *S*s the longest single reaction is not as good a criterion as the A.D. or crucial difference. It is a correct indication 4 times and an incorrect indication 3 times. Fifty-seven percent. of the judgments are correct and the diagnostic certainty is .14.

4. *Qualitative Indications*

Seven of the sophisticated *S*s were correctly judged guilty by the fact that the response words were closely related to the story. Three times associations which apparently came from the story misled us, and an incorrect judgment was made. Seventy percent. of the judgments were correct, which gives a diagnostic certainty of .40. In each of the three cases where the judgment was incorrect there were more than one misleading association; in one case there were as many as eight. In this last case the *S* wished the *E* to think she had read the story which she had not. She guessed at the setting by the words given, and gave associations seemingly from the story (sometimes giving as a response a word which had previously been used as a test-word). With some care it would be possible to make a list of test-words where this device could not be used. When the *S* wishes to appear innocent the danger of this method being used is not great.

In the 7 cases where the *S* was correctly judged guilty, there were two instances where 5 associations were based upon the story, and one instance where there were 4 associations of this nature. In contrast to these results, 4 of the naive *S*s gave no crucial associations and two gave only one. In the other test (where the *S* was not guilty) there was one response which the *E* felt was of possible significance, but which must have been due to chance. The explanation may be that the naive *S*s guessed at once that the nature of the association was important, but did not realize that reaction-time would count heavily. Therefore they slowed up on test-words (as the Table shows) and succeeded in repressing a tell-tale word. The sophisticated *S*s on the contrary realized the importance of the reaction-time and strove to keep it low, a procedure which sometimes resulted in an incriminating association.

Leach and Washburn[4], who experimented under very simple conditions and made correct judgments 52 out of 53 times, considered that of the qualitative indications the misunderstanding or misinterpretation of a test-word was very im-

[4] *Op. cit.*, p. 162.

portant in indicating innocence. For example, when the crime consisted in the *S* looking into a box containing a bottle of red ink, the test-word "write" was given. The subject responded with the word "wrong." The authors argue that the *S* was innocent because if she had seen the ink, she would certainly have recognized the word as w-r-i-t-e.

Without intention on our part, the test-words gave many opportunities for a double interpretation on the part of the *S*. If we base our judgment upon this criterion we obtain 9 correct judgments and 10 incorrect ones with the sophisticated *S*s and 2 correct and 3 incorrect ones with the naive *S*s. The percentage of correct judgments for the sophisticated *S*s is 48 and the diagnostic value (if the criterion is reversed) is .04. For the naive *S*s the percentage of correct judgments is 40. Reversing the criterion gives us a diagnostic value of .20.

Apparent refusal to give associations at all, that is to say, failure to follow directions, occurred 5 times among the sophisticated *S*s, but led to a correct judgment only twice. The percentage of correct judgments is 40 and the diagnostic value is .10, provided the criterion is reversed. In the naive group there was only one such instance and the *S* in question was not guilty.

5. *Combined Criteria*

Since each criterion alone led to many incorrect judgments among the sophisticated *S*s and to one or more incorrect judgments even among the naive *S*s, it seemed advisable to test the reliability of a combination of criteria. The *E* therefore considered all criteria in every case and refused to make a decision when the evidence was contradictory.

Among the sophisticated *S*s there was one case where all the criteria were present and were of positive value. In addition there were 6 cases where the criteria which were present were positive or of very doubtful negative value. We may say, then, that we have 7 fairly clear-cut cases for correct judgment by the use of a combination of criteria. Four of these occur in test A, that is to say, early in the series. There were 2 cases where every indication which was present was incorrect, and which therefore led to 2 incorrect decisions. Among the naive *S*s there were 4 cases where every indication except one (of very doubtful negative value) was positive. There is one case where every indication was negative.

IV. Methods Used as Reported by *S*s

The following are methods which the *S*s reported.

(1) Lengthening the reaction-time to certain non-crucial words. (2) Lengthening all reactions so much that there would be plenty of time to think of reactions to crucial words

and yet not cause a large crucial difference. (3) Associating of non-crucial words with others in the same set (done in the case where two stories were given to the *S*s). (4) Thinking, before the test, of associations to the test-words which would probably be used. (5) Noting test-words which might be misunderstood by an innocent *S* and preparing associations (Chess—Nut; Pale—Bucket). (6) Sparring for time by asking, "What was that?" (7) Using a definite mental set, such as giving definitions, no matter what word appeared.

V. Conclusion

The above results show that under the conditions of this experiment (in which no emotional feature was introduced) sophisticated *S*s can prevent detection much of the time. If all criteria are considered, we find that out of 23 tests with 5 sophisticated *S*s we can make 7 correct and 2 incorrect judgments, leaving 12 on which we can make no decision. If we take our most reliable single criterion (longer average reaction-time) we can make 14 correct and 9 incorrect judgments. If we take the A.D. as a criterion we can make 9 correct and 14 incorrect judgments, exactly reversing the results of our most reliable criterion. It seems clear that the method is unreliable when the *S*s are sophisticated.

The naive *S*s, on the other hand, were not so successful in preventing detection. The average reaction-time and the A.D. were correct indications 6 out of 7 times. Combined criteria led to a correct judgment 4 out of 7 times. But there is one case (in which the *S* was not guilty) where a wrong decision was based upon a number of apparent indications of guilt.

This Study suggests several problems for further investigation. It would be interesting to see how much the introduction of an emotional feature, such as is present in the case of a real crime, would affect results. Could the sophisticated *S*s maintain their record? If they were detected the first time, could they learn to cope successfully with a series of new situations?

The question also arises as to the success of sophisticated *S*s compared with naive *S*s when the *E* did not know to which of these classes each *S* belonged. Could sophisticated *S*s not only prevent detection of their crime, but also prevent detection of their sophistication?

AN EXPERIMENTAL STUDY OF FEAR

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In the vast literature dealing with emotion, one searches in vain for any attempt to make an experimental analysis and description of an emotion from a psychological point of view. One reason for this lack is the frequent assertion that an emotion can not be brought under experimental laboratory control.[1] The physiological changes characteristic of emotion have received their full share of attention.[2] Work in this field has, however, left the psychological aspects of emotion just where they were. One can not go from quantitative changes in the secretion of adrenalin, for instance, to the qualitatively different emotions.

The present investigation was undertaken to determine experimentally to what extent an emotion can be made the direct object of observation and description, and to work out so far as possible the description of a particular emotion. We chose the emotion 'fear' because the concept of it seemed to us to be the most restricted and clean-cut of the emotional concepts. In the absence of any physiological symptom which unequivocally indicates the presence of fear, we had recourse simply to *O*'s report that he felt fear. If, by emotion, we mean a mental experience, this is the ultimate proof of its existence.

Procedure I.

The experiment was carried on in a dimly lighted room with dark grey walls. *O* sat in an easy chair facing a dark corner. *E* always remained behind him. *O* read the following instructions at the beginning of every observation period: "I am going to present to you a stimulus. Let it have its full normal effect and respond to it naturally. After I say 'Now' describe your experience as completely as you can. After the 'Ready' signal, close your eyes, and keep them closed until after I have said 'Now'. You may then open them if you wish." We found it necessary in the course of training to caution the *O*s further: "Don't try to tell what the object is, but describe *your* experience in the situation. Be 'subjective' and personal rather than objective. Deal with yourself and do not try to understand what is going on." *O* was always asked to sit with his arms on the arms of the chair and his hands spread out. About 10 stimuli

[1] In his *Textbook of Psychology*, 472 ff., Titchener points out this lack of psychological investigation in the field of emotion and maintains that emotions are susceptible of laboratory study and analysis.

[2] W. B. Cannon, *Bodily Changes in Pain, Hunger, Fear, and Rage*, 1920.

were presented at every period, and an interval of 3 to 4 min. was allowed to elapse between presentations. When the stimulus was visual, the light was thrown on the object, and *O* was told to open his eyes. The *O*s were three undergraduate girl students and observed over a period of 18 weeks. Every *O* gave a total of 350 reports.

Seventeen different stimulus objects were employed, including things that would give rise to only moderately affective experiences and to pleasant emotions as well as to fears. The presentation of a large number of situations that would arouse other than fear experiences was designed, first, to prevent the *O*s from becoming too sophisticated with regard to the experiment, and secondly to avoid making it predominantly disagreeable. The several stimuli in the order in which they were introduced into the experiment were: odors (pl. and unpl.), sandpaper, warm velvet, loud noise (bang), feather, tuning fork touched to the face while in motion, file on tin, whistle, blast of air, rubber glove filled with water, preserved brain, preserved frog, soaked macaroni, wet rubber snake, cold metal, pictures of snakes.

Results

Emotional Characterizations. Only those reports in which *O* included an emotional characterization indicate situations which are adequate for the arousal of fear. Typical expressions of this sort are: "I was frightened", "It felt horrible", "It was simply awful". The numbers of such reports of emotion were for the 3 *O*s respectively 50, 29, 22.

Analytical Descriptions. In addition to giving the emotional characterizations, the *O*s also analysed the experiences and reported their sensory, imaginal, and affective components. The affective element showed the greatest constancy, in as much as every experience that was characterized as 'fear' also was described as unpleasant.

The sensory components of the emotional experiences split into two types; first, those that were localized externally and were referred to the stimulus object; secondly, those that were localized internally and perceived as 'subjective', *i.e.*, organic. The factors that remained constantly present in all the descriptions that we obtained were the sensations directly set up by the stimulus, and the affection of unpleasantness. Neither organic sensation nor imaginal supplementation was invariably present.

O	No. of emot. char.	% sn. local. in stim.	% unpl.	% organ.	% organ. image	Supplementation % image	total %organ.	total %image
S	50	100	100	54	30	16	84	46
M	22	100	100	50	23	23	64	50
P	29	100	100	55	20	25	75	45

The Table of the reports shows that organic sensations in some cases formed the greater part of the vivid and reportable experience; that frequently, however, these sensations were further supplemented by images; and that many times the images themselves made up the whole of the focal experience, and any organic sensations that may conceivably have been present were marginal, and hence neither reportable nor a part of the emotion as experienced.

Samples of Reports: Organic Sensations Focal

S. "That frightened me, and made me jump, it felt so horrible, so wet and cold and clammy and unpleasant. I felt my hand draw away from it and something inside me 'caught', *i.e.*, there was a pulling and swelling pressure in the region of my stomach, when it first touched me. I didn't even stop to think what it was."—Stimulus, rubber glove.

M. "Oh, that was awful! It made me feel 'all mixed up' inside. It was so wet and cold and horribly unpleasant. I felt myself squirm."—Stimulus, rubber snake.

P. "That was unpleasant. It produced a sinking, sick feeling in my stomach. It was horrible, and made me want to get away from it."—Stimulus, human brain.

Organic Sensations and Images Focal

S. "That is a violent reaction. It feels awful. It makes me shiver and shake inside and my stomach feels 'all mixed up.' It is so ugly and awful. It is the most unpleasant feeling I have ever had. I can't control myself. I want to wipe it off my hand. I think (visual image) it is a bunch of worms and I have always had a horror of worms."—Stimulus, soaked macaroni.

M. "That scared me and made me feel shaky. It was an unpleasant sound. It made me think (in visual images) of an explosion."—Stimulus, loud noise.

P. "That was horrible,—very unpleasant. It was a wet slimy feeling. It made me feel creepy all over and sort of sinking inside. It felt like a lot of wet angle-worms (visual and verbal images)."—Stimulus, soaked macaroni.

Images Focal

S. "That felt cold at first; then I thought that it was the glove (visual and verbal images) and became frightened and wanted to draw my hand away. It was unpleasant."—Stimulus, cool metal.

M. "That always scares me, and is unpleasant. I think of a huge hammer (visual image) striking near me and I don't want to be struck."—Stimulus, loud noise.

P. "A cold wet pressure at first; then I got to thinking that it was that frog (visual and verbal images) and it became very unpleasant and repulsive, and I wished that you would take it away (kinaesthetic images)."—Stimulus, cold metal.

Procedure II.

The rôle of images led us to attempt to control and to vary the imaginal setting of the stimuli, and to record the accompanying changes, if any, in the emotional aspect of the experiences. This aim was accomplished in the following manner. A certain stimulus, the rubber glove, had constantly and invariably evoked a violent fear on the part of one *O*. The mode of presentation was varied in two ways. Instead of having the

stimulus placed unexpectedly on his hand, *O* was told to open his eyes and grasp the glove. The experience under this presentation was unpleasant, but never gave rise to an emotion, though organic sensations were often reported. In as much as *O* had seen the stimulus and now could visualize it or represent it to himself in other imagery, he was told, "This is the rubber glove", and was then stimulated. The result was sometimes an emotion and sometimes not. The organic sensations were frequently present; but whether an emotion was experienced or not was determined by the absence or presence of images of the rubber glove. A vivid representation of the stimulus as the rubber glove *O* had seen resulted in no emotion even in the presence of strong organic sensations.

Samples of Reports

S. "That felt cold and clammy and nasty, and my stomach felt contracted; but I was not frightened as I used to be."—Stimulus, seen and touched.

"That was rather unpleasant and made my stomach start to feel queer; but when I realized that it was the rubber glove (visual and verbal images), it stopped, and that was all. I was not frightened."—Stimulus with knowledge.

"That frightened me (*O* screamed). I feel completely out of breath and my stomach caught inside. I couldn't help but yell. Shivers went over me. I didn't think it was the glove. As soon as I did realize that it was the glove (visual and verbal images) I was no longer frightened, though I still feel queer inside and am out of breath."—Stimulus without knowledge.

We next attempted to produce an emotional experience by the addition of an imaginal setting. In what to *E* was a preceding situation, we presented a stimulus that was likely to carry over in imagery to the succeeding stimulation. For instance, a picture of snakes was shown, and then after a shorter interval than usual cold soaked macaroni or a thin rubber tube filled with wet sand was placed on *O*'s hand. The result was a strong emotion which included always images of the picture and sometimes organic sensations. Another arrangement of stimuli that produced similar results consisted in placing on *O*'s hand a piece of cold metal and at the same time bringing near his nose some of the preserving fluid in which the brain and frog were kept. Whenever the odor called up the image of one of these stimuli, *O* experienced an emotion.

Samples of Reports

P. "A cold, wet, clammy feeling. It was horrible, repulsive and slimy, and felt like the snakes or worms I had just seen in the picture."—Stimulus, soaked macaroni.

"Oh, that was awful! It was wet and slimy. It made me feel creepy all over. I saw that picture of crawling worms. It was horrible and unpleasant."—Stimulus, cold soaked macaroni.

M. "I thought you were putting that frog on me (visual image) and I had the queer feeling in my stomach and was frightened."—Stimulus, rubber glove.

"A cold wet clammy pressure and the smell of that frog (visual and verbal images) which made the experience horrible and repulsive. It gave me the creeps all over, for I thought you had put the frog on my hand (visual and verbal images)."—Stimulus, preserving fluid and cold metal.

It appears from the foregoing examples that the presence of fear depends not upon any particular group of processes such as organic sensations, but rather upon some perceptual meaning of the object for *O*, a meaning which is carried by the particular sensations, images, or both, that are called out by the stimulus. A re-examination of the reports brings out the general nature of this meaning. The emotional characterizations of the experiences were accompanied in most cases by a further, explanatory statement of the nature of the experience. This explanatory statement always indicated that the experience signified a negative motor response. "I wanted to withdraw from it and wipe it off my hand;" "It is something I don't want to touch;" "I didn't want to look at that;" "I wanted to get away from it." Sometimes the response was actually carried out; at others it was merely 'felt', *i.e.*, imaged kinaesthetically, while often it was represented in other than kinaesthetic terms. But the meaning was always that of movement away from the stimulus.

Conclusions

Our investigation has demonstrated, first, that emotions may be set up under laboratory conditions and be subjected to psychological description. Also, it has enabled us to work out the gross structure of the emotive pattern in the case of fear. This pattern is akin to the pattern of perception,—core and context. It is related, likewise, to the pattern of the action consciousness. The core of an emotion consists, as in the case of perception, of those sensory elements that are referred to the stimulus. In addition, there is a context which consists of images or sensations or both. An as integral part of both core and context, there is always an affective element,—in the case of fear, unpleasantness. In the cases of intense emotions and of certain individuals, the sensations of the context, which are principally organic, probably play the dominant rôle; but their presence does not guarantee that the experience shall be an emotion, nor does their absence preclude emotion. A definition of emotion that includes only those emotions in the contexts of which organic sensations predominate makes an unwarranted restriction of the term and excludes experiences that are felt as emotions.

The emotive pattern resembles the fore-period of the action consciousness in as much as it carries the meanings both of a movement on the part of the *O* and of the result of that movement. The fact that the truly emotional aspect of an experience is the meaning of a particular type of response to the situation

throws light on the wide differences one finds among the various classifications of the emotions. Such classifications, obviously, are not based on the mental components or the patterns of the emotions, but rather upon the action-meanings which the particular patterns of the particular mental elements carry for the experiencing individual. They are, therefore, not psychological but logical, and are determined by the classifiers' tendencies to explicate or to generalize and by their evaluation of the responses.

MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF McGILL UNIVERSITY

Communicated by WILLIAM D. TAIT

I. AN EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF CERTAIN WEATHER CONDITIONS UPON SHORT PERIODS OF MENTAL WORK

By J. P. BETHEL

Introduction

The direct and qualitative relationships existing between weather conditions and mental processes furnish a field of experiment and research which has attracted surprisingly little notice in psychological circles. While it is true that a great many articles and reports make reference to the subject of weather conditions and their effects on mental work, such references are merely suggestive, theoretical and entirely incidental to the reports in which they occur. Many and varied experiments have been carried on, and valuable data have been accumulated in consequence, concerning the existence and nature of certain definite curves of periodicity —diurnal and seasonal—of mental work; yet Robinson affirms that, from the facts now available, it is impossible to arrive at any statement of the diurnal course of efficiency which has a very wide applicability. In spite, furthermore, of these numerous investigations, the experimenter in the field of weather conditions alone will find that there are very few previous data (excepting, of course, mere theorizing) which he can verify or contradict, with the exception, perhaps, of findings in the sphere of seasonal periodicity. There are, however, several important facts which can be gleaned from the previous records—hints as to methods employable, and pitfalls to be guarded against.

Historical Survey

Before proceeding with a report of my own experiment, it will be advisable to give some brief summary of the work of previous investigators, which affects, even indirectly, the special problem before us.

(1) As early as 1859 the physiological value of the weather began to be observed by E. Smith, who showed in his "Analysis of Respiration" that breathing is at a maximum in spring and at a minimum towards the end of summer and beginning of autumn. Finsen next discovered a seasonal variation in the amount of hæmoglobin in the blood, and Lehmann showed experimentally that there is a corresponding periodicity in the strength of the heart-beat. Malling-Hansen discovered that the height and weight of growing boys seemed to be subject to periodic variations which recurred year after year in the same manner. Besides such general physiological periodicity, more specialized topics began to attract attention, and the results of various investigators are summarized by Peaks in his work "Periodic Variations in Efficiency[1]."

(2) Schuyten: Periodicity of Attention.—School children were tested once a month, the test being repeated 4 times each test-day. Each child sat with his Flemish Reader open before him: at a given, unchanged signal they all began reading silently. The *E* observed those who were not attentive, those who stopped reading, those who raised their eyes, and those who were continuously active during 5 min. The investigation was begun

[1] For the purpose of our present study we may neglect the various experiments (of Schuyten, Lehmann, Pedersen, Marsh and Peaks, etc.) dealing with periodicity of muscle strength or physical abilities alone.

in March, 1893 and continued for 10 months (August and September being holiday months). From his general results for the year Schuyten notes the greatest difference between March and July, and upon these results bases the conclusion that the power of attention in children is inversely proportional to the atmospheric temperature.

In order to satisfy himself that the results were valid, Schuyten made a second series of experiments, using the same general method of study as before, with one exception—he began in April instead of March. From these results he concludes that (*a*) the second test verifies the results of the first; (*b*) rest has a good influence on attention; (*c*) intermissions are more beneficial in summer, more beneficial to lower classes, more beneficial to boys.

The faults of this experiment are: (*a*) the neglect of quantitative measurements; (*b*) the neglect of the obvious fact that the assigned readings would not interest all the children equally; and (*c*) the unwarranted conclusions drawn from the same test 4 times a day every month. Furthermore, Peaks does not agree with Schuyten that the results of the second experiment verify those of the first.

(3) Lobsien sought to supplement and verify the work of Schuyten in a similar investigation. In gathering the data, experiments were made on the boys and girls in the public schools of Kiel, from 8 to 14 years of age, on the 15th day of each month from September 1901 to June 1902 (July and August being holiday months). Lobsien's work is limited to the study of primary memory for lists of 10 words involving both visual and auditory imagery, *e.g.*

LIST A

Visual	*Acoustic*
Sonnenlicht	Gesang
Fenstercheibe	Gebell
Wandteller	Summen
Handspiegel	Sausen
Himmelblau	Rasseln

The word-lists were spoken plainly, after which each pupil was asked to write the words in a list at once. Lobsien tabulated the results separately for girls and boys, and for each age. The curves for boys and girls are much alike: in general they show a high period or crest around December and January and a trough or depression in February and April. The visual tests show a curve which is higher in the first than in the last part, a fact which Lobsien considers the more remarkable because pupils should improve with practice.

Peaks thus criticizes Lobsien's work: "While very carefully worked over," it "seems to be somewhat questionable both in the materials and in the procedure. While the method was new, the word materials are so much alike in form that the memory-images undoubtedly interfered with one another . . . Then again, there are so many accidental factors which enter into mental abilities, due to time of day, temperature, individual daily results, etc., that it is doubtful in the extreme that the results from tests made but once a month are a true index of any but accidental factors, and that the seasonal rhythms can be discovered from tests taken but once a month. The mere fact that such a large number of persons were tested cannot overcome this source of error in the procedure."

(4) In 1906, Marsh began a series of experiments at Columbia University dealing with the daily variations in mental, physical, and psychophysical efficiency. Mental tests were made in association, memory and addition, all of which showed that 12 m. to 2 p.m. was the most favourable, and 9 to 11 p.m. the least favourable time of the day.

(5) Gates made two elaborate series of investigations on the diurnal course of efficiency; a few of his conclusions are of interest in the present investigation. There is, he says, a positive correlation shown between visual and auditory memory, on the average. The correlation of these two functions in one case runs up to +.93 and is only slightly lower in several others. The general average is considerably reduced by a single negative correlation which appears in one small group of boys. All the functions tested show an improvement, due to practice, in amounts varying from 7% to 33.3%.

(6) Gates' curves for diurnal efficiency, which show (*a*) a steady diurnal increase for the speed, accuracy and cancellation tests, and (*b*) a steady rise till 12 m., a drop from 12 m. to 1 p.m., and a slight rise till 3 p.m. for the addition, multiplication, memory, recognition and completion tests, are not borne out by the cancellation-test experiment conducted by Muscio on a group of factory workers. Muscio finds that efficiency for the tests gets gradually lower during the day, notwithstanding the fact that the only work done on the test-days was the actual work of the tests—not more than 7 min. per half-hour. The test-results from 4.15 p.m. onwards are definitely poorer than any other test-results during the day except the initial one.

(7) With regard to the correlation between initial ability and improvement, Thorndike makes the assertion that it is by no means perfect, fairly large differences in the latter being found between *S*s with equal initial scores.

(8) Peaks has conducted an elaborate experiment which will be described here in some detail. His investigations, which concerned periodicity as shown in both mental and physical[2] tests, were conducted during the school year October 1910 to June 1911. The tests were made on two groups of students in the First Year of the Manual Training High School of Washington University, St. Louis, Mo. The tests were all made under Peaks' personal direction at hours ranging from 9 a.m. to 3 p.m., at a time when classes came to his room for a study period. Many students took the tests for a part of the time, but only 10 (the B Division) took the tests daily throughout the entire period. Another group of 22 (A Division) took the test every Friday. Owing to the amount of time consumed by the tests it was not possible to give more than one physical and one mental test daily.

Periodicity as shown in Primary Memory.—(*a*) The purpose of the tests was to discover any periodic variations in mental ability during the school year, and to see how these variations compared with those found by other investigators of mental ability and with his own physical tests. (*b*) Method and procedure were as follows. A series of 4 numbers, as 84, 26, 47, 32, was read at the rate of 1 per sec. At the close of the series the class was allowed 15 sec. to reproduce the series in order of presentation on a record blank provided for this purpose. The blank bore particulars as to the character of the day and the pupils' score in the physical test.[3] After the 15 sec. of reproduction a second series of 5 numbers was read: then a final series of 6 numbers. The pupils were also asked to introspect and record any factors which helped or hindered their reproduction of the series. Marks were awarded as follows: 1 for every correct whole number in right order; ½ for every correct whole number in wrong order; ½ for a number with one digit correct. (*c*) A series of preliminary tests was given on 3 days, and the pupils were told the purpose of the test. (*d*) Results:

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[2] The physical test is here omitted.

[3] Since the pupils knew the purpose of the tests, Peaks may not have been altogether wise in allowing them to see their scores for the physical test just before doing the mental test.

in this investigation the averages for each day, each week and each month were computed for the individuals, for all ages and for each group as a whole. The monthly variations for primary memory for both the A and B Divisions are shown by the following Table.

Div.	No.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Avge.	High	Low	Grist-Var.
A	22	10.2	10.8	10.6	10.7	10.5	10.7	10.7	11.1	10.7	10.7	11.1	10.2	0.9
B	10	9.1	10.0	10.4	10.6	10.2	10.2	10.2	11.2	11.0	10.4	11.2	9.1	2.1

The Table for the B Division shows a characteristic curve similar to the curve for muscular growth; that for the A Division does not show the same characteristics. The only striking similarity is found in the depression for February, a depression which is found in the curves for both mental and physical tests. "If," says Peaks, "we eliminate these special cases" (*i.e.*, older or brighter boys whose scores were considerably above the average) "and the practice-effects, we find that the curves for the B Division Memory Tests become more nearly level, the one outstanding feature being a slight drop some time in January and February. We must conclude, therefore, that the curve for primary memory shows a rising tendency with favourable influences from October to January, a period of depression for January and February and the first part of March, and a rising tendency with favourable influences from March to June."

In the mental tests Peaks affirms that the effects of practice and growth are very small. In no case in either group was a continuous monthly gain made throughout the year. With the exception of 5 individuals, every boy had made his highest record of the entire set of tests by the first of January. The following paragraph is of particular interest: "Among the 10 boys in the B Division who took the tests daily, 5 could usually be depended upon to make good scores. The other 5 were very nervous and easily became confused, making often very low records. I have taken the individual records of each boy, and by comparing them with the records of temperature, humidity, etc., sought to discover causes. In most cases the results of such comparisons are contradictory or baffling." Individual results vary so much from day to day, owing to accidental causes, that it is often difficult to see depressions in the weekly averages; but the individual monthly averages bring out the depression referred to above, in almost every instance.

(9) Of even more interest to us, however, than this carefully planned and executed work of Peaks' are his remarks on the influence of weather-conditions.

The first American to investigate the field of weather influences to any extent was Dexter. He collected statistics of truancy, delinquency, etc. In each case the relationship to weather conditions is purely statistical, based on the probability or expectancy of occurrence. Temperature seems to be most influential of all the weather-factors. Dexter finds that normal work goes on when temperature is between 69° and 73°F. Hines finds that 68°F. gives the best results. Lehmann and Pedersen find that rapidity of addition varies inversely as the temperature, the variations in rapidity beginning only after variation in temperature has continued a short time. They conclude that a study of weather influences may have practical as well as theoretical value.

The effect of humidity is in general the same as that of temperature. Kuhnes found that 75% to 85% relative humidity was most favourable to best work, and when rel. hum. fell below 50% there was a marked drop in efficiency.

There is much difference of opinion as to the effects of barometric changes. The general idea seems to be that of Dexter, that the effect of a low barometer and high altitudes is invigorating. On the other hand,

however, Kuhnes found that a barometric pressure of about .10 above normal seemed to be most favourable; and Lehmann and Pedersen also found an increased efficiency with high barometric pressure.

While Peaks' own data of weather-influences are concerned chiefly with the character (*i.e.*, cloudiness or sunniness) of the day, they also show that while a moderately high humidity is favourable for temperatures of from 40° to 80°F., it is unfavourable when the temperature is below that point. On the whole Peaks seems to think that the larger yearly variations in abilities are due to the combined influence of temperature and light-strength.

New Experiments

(1) My own experiment was conducted in the McGill Psychological Laboratory during the greater part of the session 1923-24. The *S*s were 5 men and one woman from the sophomore, and one woman from the junior year in Arts. These students volunteered to act as *S*s and took the tests seriously. Each student came once a week to the Laboratory, except on holidays.

The tests were of two kinds, a visual memory test, and an auditory memory test. The method of administration of the tests was as follows. (*a*) The *S* was given a list of 15 nonsense syllables to study for 3½ min. At the end of that time 1½ min. was allowed for the reproduction of as many of the syllables as could be remembered. (*b*) Two lists of numbers were read successively in the following manner: a list of 4 two-digit numbers was read at the rate of 1/sec., and then reproduced by the *S*; a list of 5 numbers was read and reproduced; a list of 6 numbers. The same procedure was carried out for a second similar series of numbers. (*c*) The nonsense syllables were again reproduced. The method of scoring was as follows. (*a*) Syllables: each correctly reproduced syllable received one mark, irrespective of whether or not it was in its correct order. For the purposes of my experiment this method was preferable to Lyon's complicated method of scoring (counting marks for individual letters and for correct order—which latter would unnecessarily increase the tax upon the *S*'s attention). (*b*) Numbers: the method used was the same as that adopted by Peaks: one mark for every correct whole number in right order; ½ mark for every correct whole number in wrong order; ¼ mark for every correct digit in correct order (total 15 marks). I subjoin specimen lists.

(1)	(2)
BAZ	(*A*) 43, 75, 91, 26.
HEK	82, 19, 65, 37, 41.
MIB	54, 69, 27, 13, 81, 46.
WOD	
JUX	
KAK	(*B*) 19, 74, 53, 26.
GEB	87, 35, 42, 16, 93.
RIN	12, 24, 36, 78, 59, 81.
BON	
ZUL	
YAB	
HEX	
SOF	
DUJ	
KIZ	

A series of preliminary tests (varying in number from 3 to 5) was first administered to enable the *S*s to become acquainted with the nature of the tests, and to obviate, as far as possible, the practice-effects.

The barometric records are those of the McGill Observatory (the altitude of which is approximately the same as that of the Laboratory).

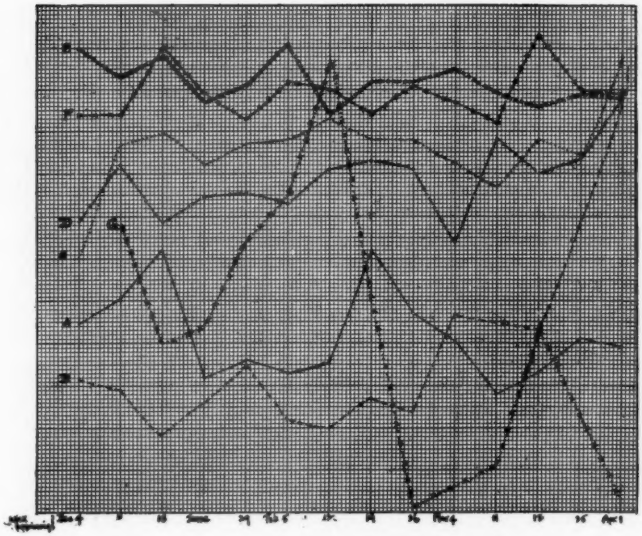

FIG. I. TABLE OF WEEKLY AVERAGES

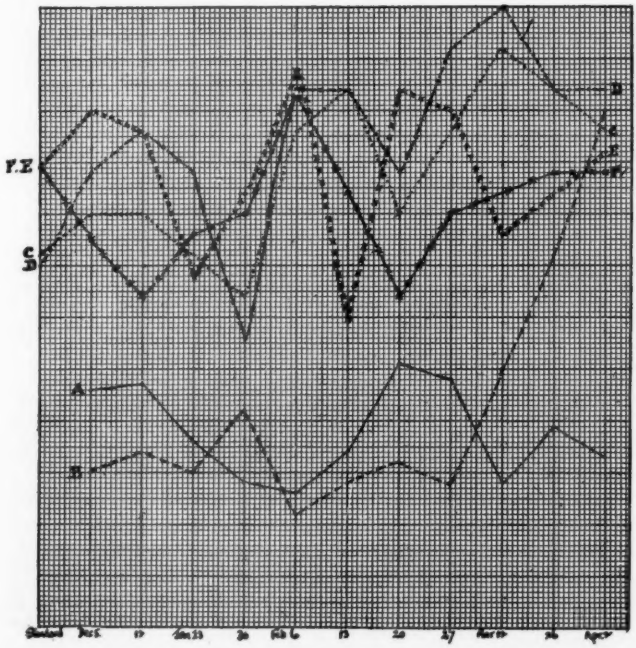

FIG. II. TYPICAL INDIVIDUAL RECORD

Symbols: A = Barometer
B = Relative Humidity
C = "Immediate Recall" Syllables
D = "Delayed Recall" Syllables
E = Nos. I
F = Nos. II
G = Temperature

(2) Sources of error are easily found. (*a*) Morgan has pointed out that irrelevant noises leave permanent effects on the memory. Absolute quiet for my experiments was not always attainable, and the test of 2 of the *Ss* on March 11 was seriously disturbed by extraneous noises. (*b*) Entire absence of meaning in the syllables is almost impossible: *e.g.*, in the specimen list given above 2 of the *Ss* were able to fix the last two syllables, because, pronounced in a certain way, they formed a friend's name. (*c*) The personal equation, *i.e.*, the individual variation in each *S* from day to day, in general health, fatigue, mood, interest and lack of interest, is an element which cannot be controlled experimentally. A passing mood or a state of fatigue at the time of learning or of testing will entirely alter the usual result.[4]

(3) Results have been drawn up graphically both for the individual *Ss* and for the weekly averages of the group as a whole; but, for convenience, only one individual record, selected at random, will be used.

In general, the results are baffling. When the individual records were examined, it was seen that in 3 cases there is little or no relation shown between the "immediate-recall" syllables and the relative humidity curves; in one case there is an almost perfect direct variation; in 2 other cases there is in the general curve a direct variation; and in only one case (Fig. II) is there any evidence of inverse variation even in the general curve. The "weekly-average" curves, however, show an almost perfect inverse variation between these two curves. In this latter there are only three places where direct variation occurs: (*a*) Jan. 29, where no reason is apparent; (*b*) March 11, where the curve is altered from inverse to direct variation by the poor score of one *S*, who both changed his method of learning the syllables and had to cope with particularly noticeable outside noises; and (*c*) April 1, where a possible cause of the improvement in score is to be found in the fact that the *Ss* knew it was their last test for the session.

Besides these contradictory evidences of the individual and average results, confusion is to be found in the average results themselves: *e.g.*, the relations of the "immediate-" and "delayed-recall" syllables to the relative humidity curve are contradictory, the former varying inversely, and the latter having a general tendency to direct variation.

The various relationships may be briefly summarized as follows.

A. Syllables: (1) *Relative Humidity*

(*a*) The relation of "immediate-recall" syllables has been discussed above. (*b*) The relation of the "delayed-recall" syllables is as follows. In general the "average" curve tends towards a direct variation with the humidity, and 3 individual records show the same tendency. On the other hand, one individual record shows an inverse variation; and the "average" direct variation contradicts the results of the "immediate-recall" syllables of (*a*) above (Tables II & VI).

(2) *Barometer*

(*a*) The "immediate-recall" syllables show a vague direct variation in the "average" curve and very variable results in the individual curves, from which absolutely no inference as to a relationship can be drawn. (*b*) The "delayed-recall" syllables in the "average" curve show a marked tendency to direct variation with the barometric pressure, while once again the individual records fluctuate so freely that no conclusions can be drawn from them (Tables II & VII).

[4] In this connection I neglected to obtain any introspective records from the *Ss*; so that I have been unable by this means to facilitate the interpretation of my results. Facts such as changes in the hour of rising may have had their influence; for one occasion was brought to my notice on which one of the *Ss* made the time of my experiment the time of her first appearance.

B. Numbers

If the visual-memory test, however, is barren of results, the auditory test is, in general, fairly fertile. As stated above, two similar series of numbers were read for the test. An examination of the results shows that No. II yields fairly clear-cut results, while the results of No. I are not so definite. From this and other factors (*e.g.*, speed of reproduction, etc.) it may be concluded that No. I is a necessary preliminary to ensure good results from No. II. It obviates to a great extent practice-effects, and allows the *S*s to accommodate themselves to the *E*'s voice, rate of reading, etc.

(1) *Relative Humidity*

(*a*) No. I. Three individual records show general inverse variation: but results from one individual and the "average" curve have the opposite tendency. (*b*) No. II. Five individual records show marked inverse variation and the tendency in the "average" curve is still more definite. These results are very clear-cut.

(2) *Barometer*

(*a*) No. I. In neither the individual nor the "average" curve is there any marked degree of correlation. (*b*) No. II. Four individual curves show an inverse variation and in the "average" curve inverse variation occurs quite noticeably.

(4) In addition to the influence of the humidity and pressure I have considered the relation of the scores on the "average" chart to the temperature curve (Table III & Fig. I). No. II again furnishes the most marked correlation—the general tendency being again toward an inverse variation. This inverse variation is almost as well shown by No. I. The curves for the syllables do not show any marked correlation except a direct variation in the case of the "delayed-recall" curve for the month of February.

The findings in my graphical records tend to contradict rather than to substantiate Peaks' opinion that temperature is the most influential weather-factor; for an examination of Fig. I reveals the fact that, while the variations of temperature (10° range) are far more sudden and greater than those of pressure, the memory-curves show a gradual rise or fall, more in consonance with the pressure- than the temperature-curve.

(5) Finally, a comparison of my results with those of other investigators of seasonal periodicity yields the following results. While others find a period of decreasing efficiency from December to the end of February followed by a rising period till May, my results (Tables IV & V) show very little "average" monthly variation, and where variation does occur it usually points to February as the month of increased efficiency.

Practice-effects may have had some influence in this inconsistency: but another factor may be held accountable to a greater degree—the difference in the number of experiments held each month. Peaks states that a full month's total of experiments is necessary to illustrate the seasonal variations. Since my data comprise only two (or three) in December, two in January, and one in April, any definite conclusion from them as to the nature of seasonal periodicity is unwarranted.

(6) The following general conclusions may be drawn from my experiments. (*a*) When the number-series is used for tests of this kind a complete set should be read and reproduced merely as a preliminary, to allow for accommodation and to obviate, partially, the effects of practice. (*b*) Since subjective "feelings" are fairly constant during so short an experiment (each day) it would seem that the weather influences affect auditory more than visual memory. Since the visual test was one of memorizing this inference may not be strictly accurate: but the results above tend largely to verify such a statement. (*c*) There seems to be no quantitatively-measurable influence of weather conditions on visual memory, as exercised in my tests. (*d*) Auditory memory shows weather

Table I

Week of:	Dec. 4	11	18	Jan. 22	29	Feb. 5	12	19	26	Mar. 4	11	18	25	Apr. 1
Barom.	29.01	30.01	30.25	29.65	29.71	29.66	29.71	30.25	29.93	29.81	29.55	29.66	29.83	29.79
Rel. Hum.	40.83	39.57	39.2	38.14	42.57	36.	35.	38.66	37.16	48.33	47.57	46.66	59.57	74.62
Sylls, "Imm-Rec."	7.57	10.71	11.2	10.28	10.86	11.	11.66	11.	11.	10.33	9.57	11.	10.57	13.5
Sylls, "Del-Rec."	8.66	10.28	8.6	9.28	9.43	9.16	10.16	10.33	10.16	8.	11.	10.	10.43	12.25
No. I	13 6/8	12 7/8	13 4/8	12½/8	12 5/8	13 7/8	11 6/8	12 6/8	12 6/8	13 1/8	12 3/8	12.	12 3/8	12 2/8
No. II	11 6/8	11 6/8	13 5/8	12 3/8	11 5/8	12 6/8	12 4/8	11 6/8	12 6/8	12 1/8	11 4/8	14 1/8	12 4/8	12 3/8

Table II

Correlations for Average Weekly Results

I	Imm.-Recall	(a)	Rel. Hum.	inverse	in.	in.	direct	in.	in.	in.	—in.	d.	in.	in.	d.				(inverse)
		(b)	Barom.	d.	d.	d.	d.	in.	d.	in.	d.	d.	d.	d.	in.	in.			
II	Delayed-Recall	(a)	Rel. Hum.	in.	d.	d.	d.	d.	in.	d.	d.	in.	in.	d.	d.	d.			(apparent dir. var.; conflicts with I (a))
		(b)	Barom.	d.	in.	in.	d.	d.	d.	d.	d.	d.	in.	in.	d.	in.			
III	No. I	(a)	Rel. Hum.	d.	in.	in.	d.	in.	d.	d.	—	d.	d.	d.	d.	in.			
		(b)	Barom.	in.	d.	d.	d.	in.	in.	d.	—	in.	d.	in.	d.	d.			
IV	No. II	(a)	Rel. Hum.	*	in.	in.	in.	in.	d.	in.	in.	in.	d.	in.	in.	in.			(inverse variation)
		(b)	Barom.	*	d.	d.	in.	in.	in.	in.	in.	in.	d.	d.	d.	in.	d.		

* Due to poor score of 1 subject

Table III

Temperature Readings

Week of	Dec. 11	18	Jan. 22	29	Feb. 5	12	19	26	Mar. 4	11	18	25	Apr. 1
	71.6	69.	69.4	71.4	72.5	75.7	70.	65.1	65.6	66.1	69.3	67.3	65.3
Variation with No. II		inv.	inv.	inv.	dir.	inv.	dir.	inv.	inv.	inv.	dir.	dir.	inv.

Table IV

Individual Seasonal Variations

	Sylls. Immediate-Recall					*Sylls. Delayed-Recall*					*No. I*					*No. II*				
	Dec.	Jan.	Feb.	Mar.	Apr.	Dec.	Jan.	Feb.	Mar.	Apr.	Dec.	Jan.	Feb.	Mar.	Apr.	Dec.	Jan.	Feb.	Mar.	Apr.
Hewetson	10.5	9.5	10.25	8.	*11*	7.	8.	8.25	7.5	*11*	11.5	13.75	12.6	12.25	*8*	10.75	12.25	10.	10.25	*9*
McLeod	11.3	12.	12.5	13.	*15*	11.3	12.5	12.75	13.	*15*	14.5	14.75	13.4	13.	*14.5*	15.	15.	14.4	14.5	*15*
Hyde	7.3	8.6	10.25	9.	*15*	5.7	7.	7.5	7.7	*13*	13.3	11.75	13.1	12.25	*13.5*	12.3	11.	12.25	11.6	*11.5*
Johnson	9.7	13.	10.	10.5	*12*	6.6	9.	5.7	7.25	*9*	13.1	14.25	13.1	14.	*14*	14.3	11.25	14.	13.9	*13.5*
Novick	14.5	*15*	12.5	11.4	*15*	12.5	*11*	12.	9.8	*14*	13.25	*9*	13.	12.5	*10.5*	13.5	*14.5*	12.75	13.1	*12.5*
Cossman	10.3	10.	11.5	10.5	*13*	11.3	8.5	10.7	11.	*12*	12.1	12.25	12.8	12.25	*12.5*	11.1	12.25	11.7	12.25	*12.5*
Sommer	10.	8.5	11.7	13.5	*12*	11.5	9.	12.7	14.	*13*	12.25	9.5	11.6	10.	*11.5*	8.75	9.75	10.4	10.25	*11.*

Italics = only 1 score

TABLE V

"AVERAGE" SEASONAL VARIATIONS

	Immediate-Recall	*Delayed-Recall*	*No. I*	*No. II*
Dec.	10.6	9.4	12.8	12.2
Jan.	10.3 (or) 10.6*	9. (or) 9.3*	12.7 (or) 12.2*	12.3 (or) 11.9*
Feb.	11.2	9.9	12.8	12.2
Mar.	10.8	10.	12.3	12.26

* = with Novick's score (only 1 this month) included

TABLE VI

RELATION TO RELATIVE HUMIDITY

Subject	*Syllables "Immediate-Recall"*	*Syllables "Delayed-Recall"*	*No. I*	*No. II*
Hewetson	———	———	inverse variation	inverse variation
McLeod	direct variation	direct variation	———	———
Hyde	———	" "	general inverse var.	general inverse var.
Johnson	general direct var.	general direct var.	general direct var.	" " "
Novick	" " "	———	———	———
Cossman	———	———	general inverse var.	inverse variation
Sommer	general inverse var.	general inverse var.	———	general inverse var

——— = no correlation in variation

TABLE VII

RELATION TO BAROMETRIC PRESSURE

Subject	*Syllables "Immediate-Recall"*	*Syllables "Delayed-Recall"*	*No. I*	*No. II*
Hewetson	———	———	general inverse var.	general inverse var.
McLeod	general inverse var.	vague general inver. variation	———	———
Hyde	———	———	———	general inverse var.
Johnson	———	———	———	" " "
Novick	———	vague general direct variation	———	———
Cossman	———	———	———	———
Sommer	———	———	———	general inverse var.

——— = no correlation in variation

influences to a marked extent. Relative humidity, barometric pressure and temperature appear to affect efficiency in auditory memory inversely, *i.e.*, as humidity, pressure and temperature rise, the scores for auditory memory become lower. (*e*) My results do not substantiate Peaks' opinion that temperature is the most influential weather-factor: they point rather to a closer relationship between barometric pressure and mental work. (*f*) In general a low barometer is favourable to mental work. (*g*) Initial ability and rate or amount of improvement do not appear to be quantitatively related. This result substantiates Thorndike's findings. (*h*) No really successful and definite conclusions can be drawn from an experiment of this character unless something is known of the *S*'s affective state at the time of the test. To supply this information introspection by the *S* would best serve, and is, moreover, a necessity.

While much work may be done along lines similar to the present experiment, an absolutely quantitative relationship between the weather influences and mental work cannot be established until the influence of fatigue, the personal equation, and other minor influences can also be measured to some quantitative extent.

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II. The Reaction of Memory to Affective States

BY A. RENDLE STONE

Purpose of Experiments and Introductory Remarks

In the following series of 7 experiments, I have tried to discover if there is a relation, and, if so, what, between memory and affective states. The last 6 experiments have a common method, and a much closer relation to each other than to the first one. The ground covered by these 6 seems to have been so untouched that I have been unable to compare their results with any others.

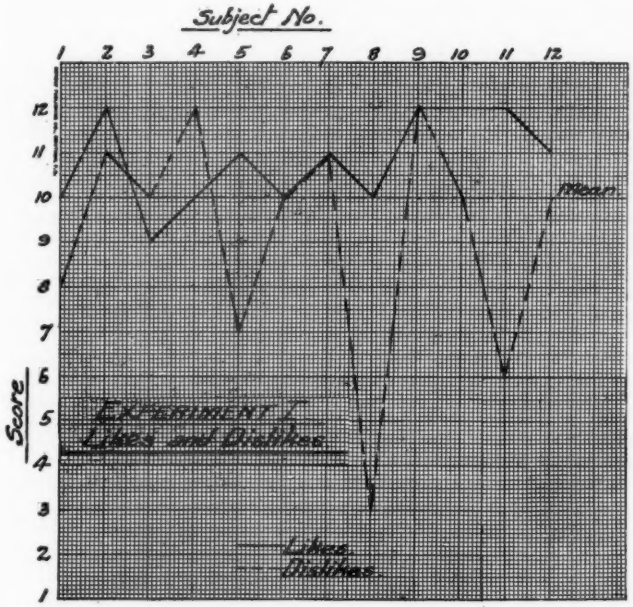
The same thing cannot be said about the first experiment, which, being along the hedonic lines of recall of likes and dislikes, is by no means the first of its kind. However, several of the experimenters have arrived at different results, and as my method seems to be a new one, it may have its place.

History of Previous Experiments

W. W. Smith[7] has given a summary of earlier experiments. For convenience, I will briefly mention some of them.

The first experiment on the recall of pleasant and unpleasant experiences was made in 1898, but the results were valueless. K. Gordon, the next investigator, found no difference in their facility of recall. Kowalewski draws some conclusions, but he is acting on an assumption that pleasant and unpleasant experiences are equal in number; so they cannot be accepted. W. W. Smith's conclusion is that memory is influenced by affective tone; the intensely toned experiences are better remembered or more easily forgotten. His inference seems justified. W. D. Tait concludes that the pleasant experiences are remembered better than the unpleasant, but adds that such a conclusion must be taken with care, as the unpleasant experiences may be remembered potentially as well as the pleasant, but may then be suppressed. A. Wohlgemuth found a slightly greater tendency for the forgetting of pleasant experiences than for the forgetting of unpleasant ones, but ends up by saying: "There is no difference whatever in the effect of each tone, as the variation is so slight as to be accounted for by individual differences." C. Fox, experimenting on

the influence of subjective preference on memory, decides that in the memorizing of two things a preference for one causes that one to be remembered better. It seems to me, however, that the way in which he draws his conclusions is questionable. His method was that of giving his *Ss* sonnets to learn. *After* they were learnt, the question was put which one the *S* preferred. But it seems to me that facility in learning would



be a cause for preference, just as difficulty in learning might prejudice a *S* against a sonnet. Baxter, Yamada and Washburn in 1917, and Morgan, Mull and Washburn in 1919 undertook two experiments along similar lines. Although the evidence was not conclusive, it showed a tendency for the temperament or disposition of the *S* to have an influence on the matter remembered: the cheerful person remembering pleasant, the pessimistic, unpleasant impressions the better.

New Experiments: Method

I now come to my own experiments. I will take up the first one by itself and then turn to the other six. In general, it may be said that the experiments were carried out on 12 *Ss*—10 men and 2 women—all students in the second year of Arts, McGill University, and all but one from the elementary course in psychology. The experiments took place in the McGill psychological laboratory, the *Ss* being taken in pairs at the same

hours weekly. There were comparatively no distractions. Gates[18] has shown that at different times of the day ability to remember varies. Memory also seems to vary with meteorological changes. However, as each experiment was completed in half-an-hour, and as the results were only compared in a relative way that will be seen when they are examined, the above mentioned influences should not affect the evidence.

Experiment 1

The particular method of Experiment 1 was as follows. Each *S* was asked to write down a list of 24 names, 12 being of people he liked and the other 12 of people he disliked. The likes and dislikes were to be in separate columns, and, if possible, composed of 6 of one and 6 of the other sex. The sex was not insisted on, however, but it was emphasized that the likes or dislikes must be really felt. About a month later the *S* was shown a series of photographs of persons he had never seen before. The photographs were, for the most part, of identical background, being cuts from the same periodical. Each picture was intended to correspond to one of the names the *S* had submitted; and while the *S* was being allowed to examine the picture for a moment, he was told the corresponding name. (This method should have been made more systematic by accurate timing of the pictures' exposures; but I think they were fairly regular.) After a brief pause, the pictures were again shown, one at a time as before, and the *S* was asked to remember the name allotted to each. The above procedure was gone through for each series separately, not both together. To compensate for any possible slight error due to learning, in half of the experiment the likes were shown first, and the rest of the time the dislikes alternated. One point was counted in the *S*'s score for every right name for the right picture. The results are shown in the accompanying graph.

My conclusions are as follows. (1) Only on two occasions does the dotted line top the continuous. It equals it in 3 more places, while the continuous is higher in 7 places. This makes the ratio 3.5/1. Therefore pleasant impressions are remembered better than unpleasant. (2) There are great individual differences in memory for dislikes (perhaps this is where temperament comes in), while there is not nearly so great a fluctuation for likes.

Remarks on Method Common to Experiments 2-7

After explaining the method in general for the remaining 6 experiments, I will take them up in detail. As a criterion of memory, the learning of nonsense syllables was used. They were unassociated and in lists of 15. I consider such material much superior to any other kind for the purpose desired—certainly better than poetry, etc. The *S* was allowed to concentrate on a list for 2 3/4 min., which, by experiment, was found to be the most satisfactory period. The times were taken with a stop-watch. When the 2 3/4 min. were up, the lists were removed, and the *S* was instructed to try to make his mind as blank as possible and try to think of nothing. After 2 min. of such passivity, the *S* wrote down on a slip of paper all the syllables he could remember. As soon as he had finished (all the time desired was allowed, but this usually amounted to not more than 2 min.) his blood-pressure was taken. The palpatory method was used, and the systolic pressure noted. A few minutes' rest interval was here interposed, after which another list of syllables was submitted, the time being the same as before. As soon as the time was up, a stimulus (the stimulus was different for each experiment, so will be mentioned sepa-

rately) was given, lasting the same time as the corresponding period o passivity. Again the *S* was asked to write down what he remembered, and the final systolic pressure was noted. Lastly, the *S* was asked to give any introspection that might bear on the result, with particular attention as to whether or not emotion was produced. Precaution was taken against any irregular fluctuation in the score of syllables remembered by submitting the *S*s to a long period—about two months—of training at memorizing the syllables. This should have eliminated any learning curves. Time was also spent in experimenting on the right length of lists, comparative values of associated or non-associated syllables, the best length of time to submit them for, the most advisable interval to allow to elapse before recall, whether the recall should be visual or auditory, and so on. I found much that was helpful in other experiments on memory. In particular, I learnt from W. Brown[10] that the number of syllables forgotten in attempted recall is fairly constant for some time after the first brief interval, in which most of the forgetting occurs. This was just what I noticed myself; so it was important to have a slight interval after the first learning to compensate for the time taken in introducing the stimulus after the second learning. In calculating a *S*'s score, order of words was not considered, but each syllable perfectly recalled was marked up as one point; half points were allowed if two of the letters were correct. The stimulus was given to arouse some type of emotion, and, as an index to the intensity in which the emotion was produced, the blood-pressure was examined. The evidence of the blood-pressure was pretty generally supported throughout by the introspection; it does not seem necessary to include all the introspection in detail in this report, however, so I will only refer to it where it is of special service. Graphs alone have been used in recording the results, as they seemed to serve all purposes most conveniently.

Experiment 2

The stimulus used in this case was an easy test in Psychology. The interval after learning was lengthened to 4 min., giving 1 min. each to answer 4 simple questions. A sentence or two for each question was all the answers called for. The *S*s were told that, although observations on the examination were to be taken for experimental purposes, the marks given for their answers would count in their final standing at the end of the year in their psychology course. Although a few were slightly suspicious, they could not be sure; and, not wanting to take any chances, all accepted it as a *bona fide* test.

The accompanying graph must now be referred to to follow the conclusions, which are as follows. (1) In this and the following graphs, when a line (either blood-pressure or score) approaches one of the lines which mark every tenth space on the graph, it denotes merely individual difference. (2) In this and the following graphs, when a line (either b.-p. or score) approaches one of the lines which mark every 5 divisions on the graph, this denotes the relation of b.-p. to score. (3) Whenever (and this holds for the following graphs) there is a noticeable jump in the blood-pressure line from a 10-division line to a 5-division line, the presence of emotion is inferred. (4) The practically uniform result may be noted that, the greater the emotion aroused, the greater is the variation in score, either positive or negative. (5) Analysis of pressure and score relations. (Under the A column the cases of lowered pressure and lowered score and, *vice versa*, increased pressure and increased score, are noted. Under B are the cases of lowered pressure with increased score and *vice versa*.)

S	A	B	Comment
1	1		
2		1	But not much change in blood pressure
3	1		
4		1	" " " " " " "
5	1		
6	1		" " " " " " "
7	1		" " " " " " "
8		1	Great difference in *S*'s scores. His low score lowest of all, so may be ruled out
9	1		But not much change in blood pressure
10		1	

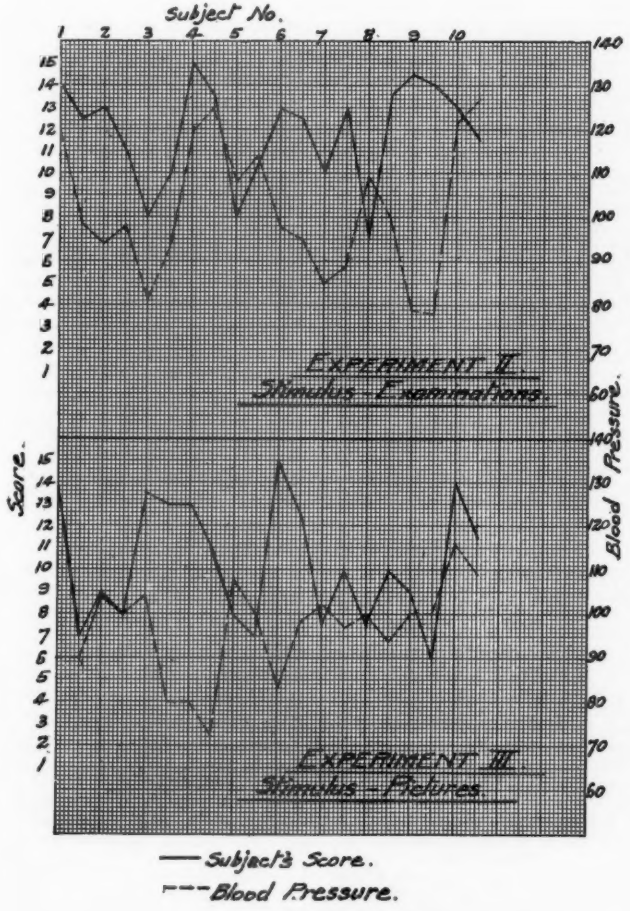
We have three good instances to one against the proposition (and its reverse) that with increase of b.-p. memory gets better. (6) In most cases the b.-p. changes for an increase.

Summary. The conclusion I would draw from this experiment is that an examination seems to stimulate quite a decided emotional excitement, as indicated by a considerable change—either increase or decrease—in blood-pressure. This emotion affects the memory of the *S* to quite an appreciable extent; the effect may be either positive or negative, *i.e.*, the memory is either increased or impaired quite largely in efficiency, depending on the individual. *The likelihood is that the blood-pressure will increase, and the memory become better.*

I suggest the following as a possible explanation. "All parts of the cortex, when electrically stimulated, produce alterations both of respiration and circulation . . . The brain itself is . . . a sponge full of blood" (W. James). Mosso's observations on the brain-pulse showed an immediate afflux of blood whenever mental activity was quickened by any cause whatever, intellectual or emotional. The emotional excitement produced by the examination, then, would affect the cortex both directly and indirectly: directly, by the stimulation of the emotion itself; indirectly, through increasing the blood-supply, and thereby making conditions more favourable to cortical activity. Sometimes we saw that the blood-pressure was lowered by the examination, decreasing the efficiency of the memory. In this case, the converse of the above would be an explanation. Of course, it is unlikely that these are the sole influences at play. Glandular activity is also much increased. A number of urinal analyses made in the United States a short time ago disclosed the presence of sugar in the urine of a great majority of a large number of students going up for examination. Under normal conditions, this would be a pathological state; so its occurrence here is illuminating. The adrenal glands are also probably active, and the increase of adrenalin in the blood should be an aid to memory.

Another interesting aspect of memory fluctuation caused by the emotional excitement of an examination is "the ups and downs" of efficiency in the same *S* during the same examination. While not approaching it on an experimental basis, I have an interesting personal experience in this connection. On the occasion of an examination in philosophy a year ago (taking place 9 to 12 a.m.) I found, after reading the paper, that everything was a complete blank. By 11 o'clock I had only one question out of 6 answered, and thought myself due for a failure. I felt greatly disappointed, as it was the last of a strenuous series of examinations, and I was convinced that I had passed all the rest successfully, and had expected to do better in this one. By a strange accident, I had set my watch an hour fast that morning, before coming into the examination. The bell rang, my watch read 12 o'clock, and I thought the time was up. I walked to the front of the room to hand in my paper; but, as no one else moved, I inquired the time from the proctor. Somehow the news that I still had another hour worked an enormous change in me. I returned to my seat

and worked without a pause till my time was up. I do not think I ever wrote faster. I nearly finished the paper, and made a second class pass, which is somewhere between 65 and 75%. This seems a good instance of such memory fluctuation.



Experiment 3

The emotion which it was attempted to induce in this experiment was horror. The stimuli were about a dozen 10 by 12 in. pictures of Russian

famine victims, particularly children, in a state of extreme emaciation. They were obtained from the dominion government at Ottawa, and were very clear, and excellent for the purpose.

The following are the conclusions from the graph. (1) The first thing noticeable is that, with two exceptions (*S*s 7 and 8), the effect of the stimulus was a decrease in the memory score. In most instances the decrease was quite decided, and in one instance (*S* 1) quite remarkable. These two exceptions are significant as occurring during the same hour and under identical conditions. It will be noticed that the *S*s made exactly the same score in both cases, and there is also only one point of difference in the decrease of b.-p. In reply to the question whether any emotion was aroused or not, their introspection was: (*S* 7) "Not moved much;" (*S* 8) "Moved to some extent, perhaps." The blood-pressure here supports this introspection, and indicates that both were moved to only a small extent, the latter a little more than the former. I imagine that all introspection in cases like this, where the emotional excitement is slight, would err in underestimating the effect. There is one possible explanation for the contradiction of these two results to the others. These two *S*s had not had the benefit of the long practice in memorizing the syllables that the others had, as they were taken into the experiments late in the session. Thus the increased score might be due to learning. If this was not the case, these two results are directly contrary to all the others. (2) The blood-pressure also decreases (with 3 exceptions, in 2 of which there was no change whatever). This seems to show that emotion was excited; but the change is not so great as in the preceding experiment. (3) There does not, however, appear to be such a clean-cut relation between score and blood-pressure. In many cases (*e.g.*, *S*s 1 and 3), where the one line indicates a great change, the other hardly fluctuates. There are 3 exceptions (6, 7, 8) to the statement that decrease in memory is accompanied by decrease in blood-pressure, or *vice versa*, and in 2 other cases (1, 9) the pressure remains stationary during a big decrease in score.

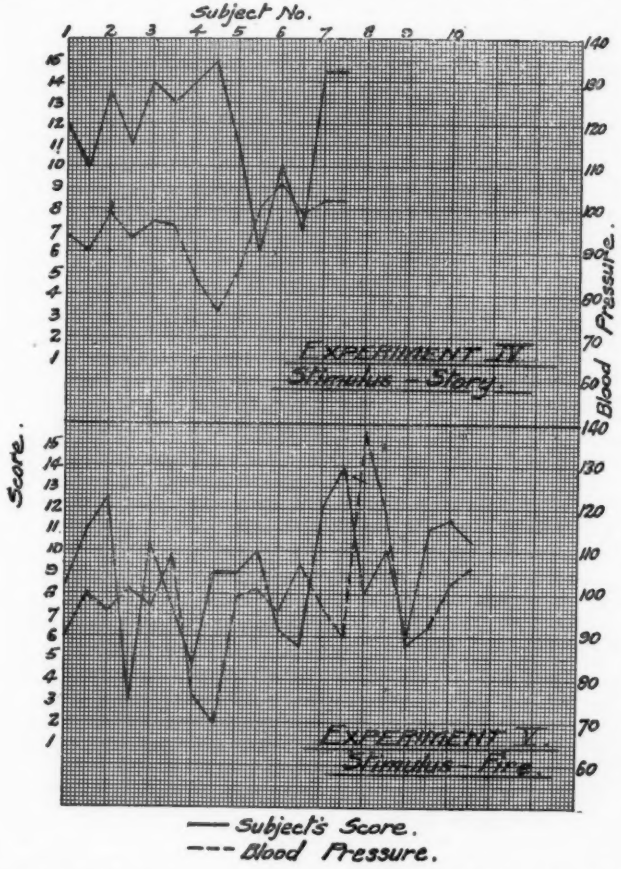
Summary. The emotion of horror reacts on memory with a negative effect.

Experiment 4

The stimulus in this experiment was the reading of a selection from Francis Parkman's "Jesuits in North America." The passage dealt with the torture by the Indians of Jesuit priests, and was full of revolting cruelties.

The conclusions from the graph are as follows. (1) This experiment has one result of particular interest to this series, *viz.*, that of *S* 7. Here the noticeable fact is that there was change in neither the blood-pressure nor the score. Looking up the *S*'s introspection, I find that he considered that no emotion whatever had been aroused in him. This is exactly in accordance with the theory on which I have been working—that, other conditions remaining invariable, all changes in memory will be due to the induced change of emotion (with blood-pressure as its index). Here the affective state is absent, so the memory stays constant. (2) The stimulus of this experiment should, from the results of Experiment 3, as the emotion produced is much the same, have a negative result on remembering the syllables. This, we see, is the case, with the exception above noted and explained, and the exception of *S* 4. A possible explanation for the other exception is this: the *S*'s introspection in this instance disclosed no emotion, therefore the fall of 8 points b.-p. was probably due to some other cause. The *S* was a little late in arriving that morning and had probably been hurrying, in which case this fall might be expected. The increase in score is only of one point, and so might easily occur without significance for the general result. (3) In most cases the hearing of the story caused the

pressure to fall. In one case (*S* 5) it rose. From the somewhat mixed nature of the emotion aroused by this stimulus, however, I do not see that the direction of the fluctuation matters much, so long as there *is* a fluctuation. It may easily be realized that excitement as to the result to the



persons in the story, sympathetic fear for what was going to happen to them, etc., might be incited instead of impersonal horror at the tortures themselves. In this case a rise in pressure might be expected.

Summary. The affective state produced by such a stimulus as was used in this experiment, which we may call a combination of horror, dread, fear, suspense, perhaps some indignation, reacts on memory with a negative effect.

Experiment 5

The stimulus for this experiment was brought about as follows. The waste-paper basket (wire) was filled with paper before the two *S*s came into the laboratory. The *S*s were seated with the basket at their backs about a yard away. While they were studying the second list of syllables, I lit my pipe and dropped the lighted match into the basket as if thinking it was out. The basket was timed to burst into flame the moment their time was up. It made quite a blaze, and was dangerously close to a desk on which were some useful papers and books. It created quite a surprise, filling the laboratory with smoke and ashes.

The reaction was usually varied. In most cases a startled exclamation was uttered. Sometimes the *S*s moved the basket away from the desk; sometimes they sat and looked at it, in which event I moved it. Sometimes they tried to put it out; sometimes they let it burn. In all cases the fire was taken for a natural accident—at least at the first, although a few began to be suspicious after a while, when they remembered that they were in a psychological laboratory.

Conclusions from the graphs are as follows. (1) The score curve for the experiment, compared with the preceding ones, seems to be most marked in its great fluctuations. Evidently the stimulus had quite a big effect, for we see (to pick out the 3 most apparent) a change from 12.5 to 3 (*S* 2); from 4.5 to 9 (*S* 4); from 6 to 11 (*S* 9), etc. (2) In 6 cases the above change was positive, in 4 negative; while the intensity was about the same for both positive and negative. (3) The changes in b.-p. are not correspondingly great. In the instance (*S* 8) of the highest pressure, 138, and the greatest change, it was ascertained that the *S* had been playing basket-ball immediately preceding the experiment, and so this change may be discounted. (4) The proportion of rises to falls in b.-p. is 7 to 3. This seems natural from the nature of the stimulus; however, the direction is not important, as the specific affective states may vary somewhat. It is only the change and the extent of the change that should matter. (5) The ideal result would be to see a perfect ratio, either direct or inverse, between the two curves. On the surface, however, this does not seem to be the case. *E.g.*, with *S* 2 an enormous drop in the score curve is accompanied by only a slight deviation in the b.-p. curve. But it seems to me that this is just one more instance where it behooves the *E* to beware of extreme results. In an experiment like this, where it is practically impossible to discover every *vera causa*, the *E* is justified in assuming at times that some influence may be at work of which he is ignorant, and so may ignore certain results which are seeming exceptions, and which he cannot explain. This, of course, only where he believes that, if explained, they would be in accordance with his conclusions.

Since writing the above, I discovered a further note on the experiment, which bears out this opinion completely. *S* 2 said he was suddenly fatigued after learning the first list, and got completely "fed up" with it; *ergo* his final score.

In this experiment I would call attention to the results of *S*s 1, 3, 5, 6, 7, 8 (with the allowance noted) and 10. Here are 7 good results with the ratios quite close to the desired.

Summary. The affective state produced by stimuli of a similar nature to the one used in this experiment has a marked reaction on memory, which it affects either positively or negatively, in direct proportion to its intensity.

Experiment 6

A list of association words was used to stimulate the emotion of "love" for this experiment. The list was intended to be suggestive of a couple "spooning" on the beach in summer, accompanied by a sympathetic moon. The *S* wrote down a response word to the one read, times of the long reactions being noted. Judging by the response words and reaction times, emotion was aroused.

Conclusions from the graph are as follows. (1) The results of this experiment seem particularly good with regard to a relation between amount of variation in b.-p. and amount of variation in score. In 5—one might almost say 6—out of the 7 cases the variation is gratifyingly proportional. (2) In 5 out of the 7 instances, the effect on the score is negative, and the proportion is the same for an inverse relation to the blood-pressure.

Summary. The emotion of "love" has a negative effect on memory in inverse ratio to the direction, and direct ratio to the intensity, of the concomitant change in blood-pressure. (This calls to mind the traditional absent-mindedness, sheepish forgetfulness, and stutterings of the lover.)

Experiment 7

Grief was the emotion experimented on. The *S* was asked to imagine the death of a mother or father and to work himself up as much as possible. The James-Lange theory of the emotions was also used in the sense of a partial cause. Taking the expression of the emotion as outlined in Darwin's work[1] as a model, the *S* was asked to simulate the bodily changes the emotion induces—relaxed muscles, slouched shoulders and head, drooping mouth and furrowed brow, etc.

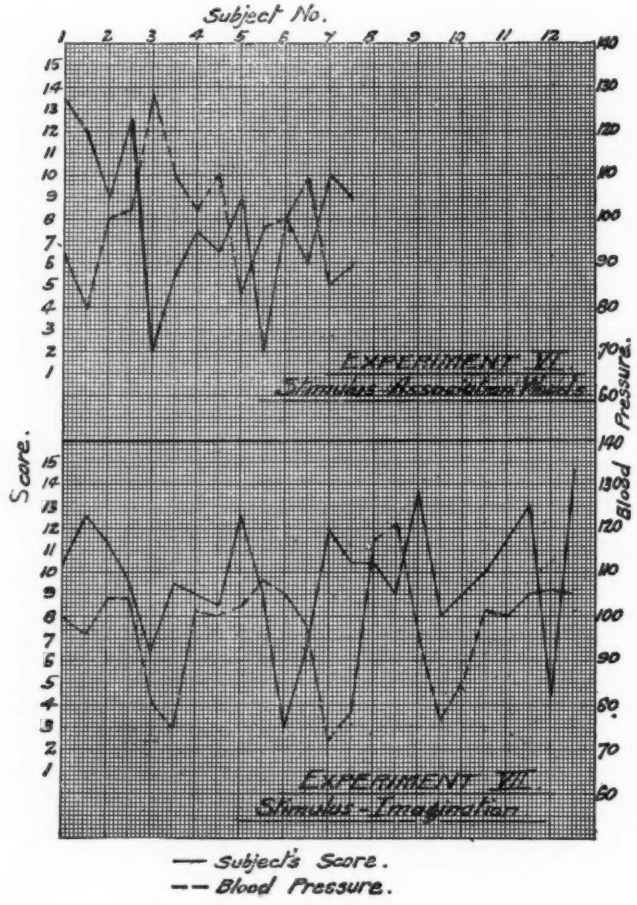
Conclusions from the graph are as follows.

(1) *S* No.	1	2	3	4	5	6	7	8	9	10	11	12	Total
Up	1	—	1	—	—	1	—	—	—	1	1	1	6
Score													
Down	—	1	—	1	1	—	1	1	1	—	—	—	6
Up	—	—	—	—	*	—	*	*	—	1	1	—	5
B.-P.													
Down	*	—	*	1	—	*	—	—	1	—	—	*	6

The asterisk means an inverse ratio.

(2) The result of *S* 2 will have to be ruled out, as it is a solitary instance of no change in b.-p. (3) The result of *S* 12 should be ruled out as: (*a*) it is a freak result in score; (*b*) the *S*'s introspection disclosed no emotion; (*c*) it is impossible that the exceedingly small change in b.-p. (explainable on the ground of natural systemic fluctuation) should indicate the reason for such a big jump in score. (4) All other results indicate a disturbing influence of this affective state on memory. (5) From the above Table (Conclusion 1) it is seen that the score may be either increased or decreased, and that the blood-pressure may either rise or fall, without any probability in favour of either direction. There seems to be some tendency for the score and pressure to be inversely related, but we should hardly be justified in setting this down definitely as a conclusion; in fact *S* 9 seems an excellent exception.

Summary. The emotion of grief has a decided influence on memory. This influence may be either positive or negative. The concomitant change in blood-pressure may be either a rise or a fall.



General Conclusion from Experiments 2-7.

Memory is greatly influenced by the *S*'s affective state at the time of the attempted recall. Some states help, some hinder; others may have either result, depending on the individual.

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MINOR STUDIES FROM THE PSYCHOLOGICAL DEPARTMENT OF NORTHWESTERN UNIVERSITY

Communicated by ROBERT H. GAULT

IV. A SURVEY OF THE INTELLIGENCE AND ENVIRONMENT OF SCHOOL CHILDREN

By TONAN FUKUDA

I. The Nature of the Study

The present Study comprises the results obtained in the survey of the school children of the Washington School, Evanston, Ill., during the months Feb. to May, 1923, to ascertain the intelligence norms and their relations to nationality, school training, and environment, factors commonly regarded as having a direct bearing upon the intelligence of the children. The first part of the paper is devoted to the study of the intelligence of the children and its relation to such factors as the teachers' estimate of their intelligence or school success, while the latter part is taken up with the study of the environmental conditions of the children and the correlation between their environment and intelligence.

For the study of the intelligence of these children the Terman Revised Binet-Simon Individual Test is used. Fortunately, in 1920, Mr. Walker, the Assistant Superintendent, tested some of the children with the Kingsbury Group Intelligence Test, and the results are still more or less available for us in checking up some of our own results. Moreover, they afford us an opportunity, though incidental to our main purpose, for the comparative study of the two tests, which will be taken up later. For the study of the environment of the children we rely chiefly upon the Whittier Scales for Grading Home and Neighborhood Conditions with our modifications.

As the city of Evanston is so situated as to connect with the northern part of Chicago, the race movement started in the maelstrom of the latter city is immediately felt by her. This fact makes our Study the more interesting, as Washington School is located in the southern part of the city, where the foreign speaking people are increasing in number. To bring out the situation we give here the names of the countries which are represented by the parents of the children here discussed, together with the number of the children studied: United States (Whites), 78; United States (Colored), 6; Canada, 2; England, 19; Scotland, 3; Ireland, 1; Sweden, 63; Poland, 27: Germany, 25; Norway, 11; Greece, 6: Bohemia, 4; Russia, 3; Russian-Jew, 3; Italy, 2; Denmark, 2; Holland, 1; Mexico, 1.

Most of these foreign-born people speak their own native languages at least at home. They are mostly laborers of various kinds. The district is usually classified as "not so favored" as the other districts of the city. The following Table will give a general idea with regard to this point.

Type of Occupation	*Number*
Business, Office work	29
Transportation work	43
Small store	37
Skilled labor	59
Unskilled labor	52
Miscellaneous	37

The Washington School is a public elementary school. The children are divided into 8 grades with 3 divisions, C, B, and A, in each grade. Although there is a kindergarten attached to this school, a study of the children in this department is omitted from our survey. The number of the children studied totals 257. The total enrollment in the school is numbered as 265, but owing to the various unavoidable causes, such as language dif-

ficulties and the impossibility of even ascertaining the date of birth, 8 children are neglected in the present Study. The following Table shows the classification of the children, according to their chronological ages.

Age	*Number*
5 to 6	1
6 to 7	15
7 to 8	34
8 to 9	23
9 to 10	33
10 to 11	29
11 to 12	29
12 to 13	34
13 to 14	27
14 to 15	18
15 to 16	12
16 to 17	2
Total	257

II. Intelligence and Correlated Factors

Naturally, children who hear a foreign language at home are handicapped in a test that is based largely on words.[1] This handicap however, falls especially upon such vocabulary tests as Terman's revision of the Binet-Simon Test. Therefore, in the present Study, we took care to substitute, whenever possible, alternative tests of non-vocabulary nature for the vocabulary tests and tests of similar nature. Of course such care does not remove the handicap entirely; but we have reason to believe that if care is taken whenever possible, such a handicap is not great even in the cases of older children with whom some use of the vocabulary tests is inevitable. As evidence we present here the location of mental age and vocabulary score of the total 148 children of rooms 5, 6, 7 and 8, to show the close relation obtained between the mental age and the vocabulary score.

TABLE I

Location of Mental Age and Vocabulary Score of the Total 148 Children of V, VI, VII, and VIII Rooms

Mental Age	*Vocabulary Score*											
	10 –14	15 –19	20 –24	25 –29	30 –34	35 –39	40 –44	45 –49	50 –54	55 –59	60 –64	65 –69
8-5			1									
9-0		4	5	2								
9-5	1	1	4	3	6				1			
10-0		2	4	2	16		1					
10-5			1	1	6		1					
11-0			1	2	12	4	6					
11-5					2	1	6	1	1			
12-0					2	1	6	1	2	1		
12-5							6	2			1	
13-0							4	2	3			
13-5								1	3	1	1	
14-0									2	2		
14-5							1		3	1	1	
15-0										1		1
15-5										1		
16-0												
16-5											1	

[1] See R. Pintner and R. Keller, Intelligence Tests of Foreign Children, *Journ. Educ. Psych.*, 13, 1922, 214–222. Also S. S. Colvin and R. D. Allen, Mental Tests and Linguistic Ability, *ibid.*, 14, 1923, 1-20.

Aside from the care taken in connection with the linguistic difficulties, the procedure in giving the test departs from the standard given by Terman in the tests of fables and the test of the similarities of three things. Instead of following the usual individual method a group testing is adopted in these two tests. It is, however, used for the rather older children of rooms 6, 7 and 8. The purpose was to save time.[2] For this task Mr. Phipps, a graduate student in Northwestern University, was engaged; but the scoring was, of course, done entirely by the writer. In giving the tests in this way the time element was neglected. The failure was carefully checked up, and was individually investigated. Of the 49 cases of failure in the test of fables none was successful after the testing without outside assistance. Of the 41 cases of failure in that of the similarities of three things only three children reported success afterwards; it was not certain whether or not they had received any outside help. Moreover, in such cases of investigation, a considerably long period of time after the testing must be seriously considered. On the whole we have seen no serious drawback in this group-method of testing as included in the present Study. The following two Tables show the cases and relation of success and failure in these two tests.

TABLE II

Distribution of Scores of the Fable Test of 101 Cases of 6, 7 and 8 Rooms

Score	*Mental Age*								
	9-0	10-0	11-0	12-0	13-0	14-0	15-0	16-0	Total
Above 8				2	3	5	1	1	12
4 to 8			10	13	10	6	1		40
Below 4	5	21	16	5	2				49

TABLE III

Distribution of Scores of the Similarities-of-Three-Things Test of 101 Cases of the 6, 7 and 8 Rooms

Score	*Mental Age*								
	9 0	10-0	11-0	12-0	13-0	14-0	15-0	16-0	Total
Plus	1	6	12	15	13	10	2	1	60
Minus	5	15	14	6	2	1			41

Results.—The following Table shows the distribution of the intelligence quotients of practically the entire school and also the median and average scores, according to the grade.

TABLE IV

Distribution of I. Q. and Median and Average Scores of 257 Unselected Children

I.Q.	*Grade*								
	I	II	III	IV	V	VI	VII	VIII	Total
130		1							1
120				2					2
110	5		3	5		2	1	4	20
100	3	9	10	4	5	7	2	6	46
90	14	21	10	14	9	9	11	15	103
80	5	6	7	8	6	7	9	7	55
70	2	1	1	5	4	3	2	3	21
60	2		1	1	1	2		1	8
50									0
40	1								1
Total	32	38	32	39	25	30	25	36	257
Median	93	95	97	94	91	91	91	93	93
Average	91	95	95	95	90	91	90	94	93

[2] Cf. E. A. Lincoln, Time Saving in the Stanford-Binet Test, *ibid.*, 13, 1922, 94 97.

The same distribution of the entire school is presented graphically in Fig. 1.

From this we see the median score of 93 and average score of 93, with maximum score of 130 and minimum of 43. These scores may seem rather low. The explanation, however, of this fact may come from our study of their relations to nationality, environment, and other factors.

The teachers made their own estimates of the intelligence of the children in their rooms. The coefficient of correlation between these estimates and the intelligence quotients is not low, being .55. The following Table shows these coefficients of correlation according to the rooms.

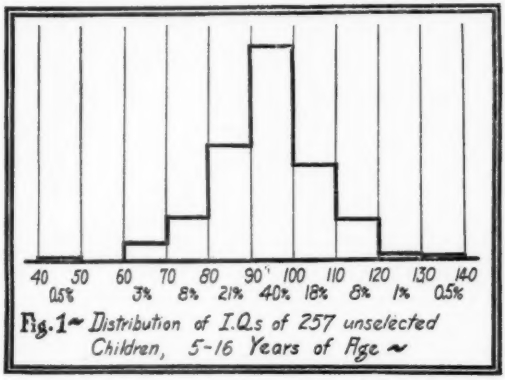


Fig. 1~ Distribution of I.Q.s of 257 unselected Children, 5-16 Years of Age ~

TABLE V

Coefficient of Correlation Between I.Q. and Teachers' Estimate of Intelligence

	Room							
	1	2	3	4	5	6	7	8
C. C.	.75	.38	.22	.58	.64	.72	.51	.62

The correlation between I.Q. and the school success of the children is, on the average, .48. The same according to the rooms may be seen in the following Table.

TABLE VI

Coefficient of Correlation Between I.Q. and School Success

	Room							
	1	2	3	4	5	6	7	8
C. C.	.76	.42	.24	.58	.57	.65	−.03	.64

In this connection it is interesting to note the distribution of the children in the grades, with regard to their mental ages. Figg. 2 and 3 show this location of mental ages in the grades, Fig. 2 showing only a more detailed classification than Fig. 3.

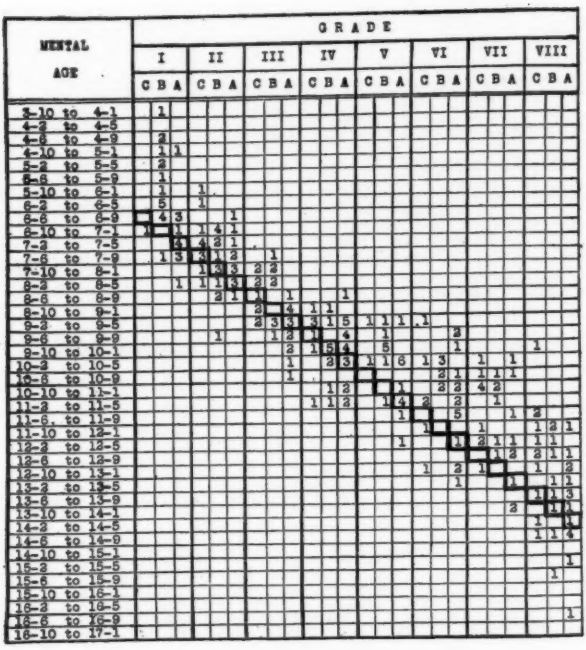


FIG. 2. Age-Grade Location of 257 Unselected Children: Washington School

MENTAL AGE	GRADE							
	I	II	III	IV	V	VI	VII	VIII
3-6 to 4-5	1							
4-6 to 5-5	6							
5-6 to 6-5	7	3						
6-6 to 7-5	13	14						
7-6 to 8-5	5	18	9					
8-6 to 9-5		3	16	13	3	1		
9-6 to 10-5		1	6	20	14	7	3	1
10-6 to 11-5			1	7	6	11	10	
11-6 to 12-5					3	7	6	8
12-6 to 13-5						4	5	9
13-6 to 14-5							3	9
14-6 to 15-5								7
15-6 to 16-5								1
16-6 to 17-5								1

FIG. 3. Age-Grade Location of 257 Unselected Children: Washington School

III. Intelligence and Nationality

The problems of the nationality and the environment of a child are perhaps those most absorbing for a social psychologist in connection with his consideration of the problems of intelligence. We now take up the first of these, to see what light the Study may throw upon the relation of intelligence and nationality.

In Table VII we give the norms of intelligence in terms of the median and average scores of the intelligence quotients which the children scored and according to the nationalities which the parents of the respective children represent.

TABLE VII

Norms of Intelligence of Nationalities

Name of Country	*Number of Cases*	*Median I.Q.*	*Average I.Q.*
United States (Whites)	78	98	97
United States (Colored)	6	88	86
England	19	93	93
Scotland	3	91	97
Canada	2	84	84
Ireland	1	96	
Total, English Speaking	109	96	95
Sweden	63	95	94
Poland	27	83	86
Germany	25	96	93
Norway	11	91	89
Greece	6	71	73
Bohemia	4	90	91
Russia	3	100	97
Russian-Jew	3	82	87
Italy	2	81	81
Denmark	2	107	107
Holland	1	105	
Mexico	1	95	
Total, Non-English Speaking	148	92	91
Grand Total	257	93	93

The results can not, needless to say, be taken seriously for those nations which are represented but by a few cases. Taking those, however, which are represented rather well, we see the distribution of I.Q. with regard to the comparative study of the English speaking class and Non-English speaking class in the following Table.

TABLE VIII

Distribution of I.Q. of Nationalities

I.Q.	*U.S. (Whites)*	*English speaking*	*Sweden*	*Poland*	*Germany*	*Non-Eng. speaking*	*Total*
130	1	1					1
120	1	1		1		1	2
110	9	11	7		2	9	20
100	17	20	13	4	4	26	46
90	32	47	26	4	11	56	103
80	12	21	10	11	5	34	55
70	4	6	5	6	2	15	21
60	2	2	2	1	1	6	8
50							
40						1	1
Total	78	109	63	27	25	148	257

The same distributions are graphically presented in Figg. 4 to 9. In Fig. 10 we give a graphic presentation of the comparison of the distributions of I.Q.s of the total cases between the class of the English Speaking and that of the Non-English Speaking. From these we see that high I.Q.s are scored by more children among the English Speaking than those among the Non-English Speaking. The reason for this fact may be attributed to the hereditary factors. We may get even more light upon this problem from the study of the environment of the children, to which we now turn our attention.

IV. Intelligence and Environment

The environmental survey in the present Study was made possible by the Whittier Scale for Grading Home Conditions and the same Scale for Grading Neighborhoods.[3] Ten items of 5 points each, making a total number of 50 points for the maximum scores, is the result from the combination of both scales for the grading of environment, and proves very convenient. Although both of these Whittier Scales, taken separately, are perhaps nearly perfect in the grading of their respective fields, yet the combined form can hardly be said to be perfect. It neglects to take into account some of the most important elements in a child's home environment, and its equal emphasis on both the home and the neighborhood makes the scale unduly over-balanced on the side of the neighborhood conditions. A child is usually moulded by direct contact with parents, relatives, and other intimate associates at home, more strongly than by the rather remote neighborhood influences, which undoubtedly play a more important part as the child grows older. In this connection it is especially important to know how the child lives at home, in what way his habits are formed, and how his time at home is spent; for it is on such factors of the home life that the development of life and character and, consequently, intellectual manifestations, are conditioned. The Whittier Scale for the Grading of Homes lacks a serious consideration of these matters; it takes two items out of the total items of five for the parental influence, Parental Conditions for Item 4 and Parental Supervision for Item 5, but none for the influences from relatives, friends and other associates nor for the mode of life and manner of the child's forming habit and character. The last mentioned factor may be intimately connected with the supervision of the parents, yet it is important enough to claim separate consideration. In saying this, the writer does not consider two items on the parental influences as over-balanced nor does he consider three other items more directly connected with the material side of the home too preponderant; these items are essential, and can never be omitted. Then, to make a combined form for grading environment consisting of 10 items and, at the same time, to include these important additional items, we turn to the consideration of the items for grading the neighborhood conditions. Here we have seen that this part, if put in the combined form on equal standing with that of homes, will result in an unduly over-balanced scale on the side of the neighborhood conditions. Among 5 items listed in the original Whittier Scale we may, then, safely group together Item 2, Recreational Facilities and Item 3, Institutions and Establishments into one item; and Item 4, Social Status of Residents and Item 5, Average Quality of Homes also into one group, thus leaving room for two of the most important items, the child's associates and his home life itself, which have been neglected.

Then the scale for the grading of the environmental conditions of the child will ultimately take the following form. *Item I.* Necessities, corresponding to Item I of the Whittier Scale for Grading Home Conditions. *Item II.* Neatness of the Home, corresponding to Item II of the same.

[3] W. W. Clark and J. H. Williams, A Guide to the Grading of Homes, *Publications of Whittier State School, Department of Research*, Bulletin No. 7. A Guide to the Grading of Neighborhoods, *ibid.*, Bulletin No. 8.

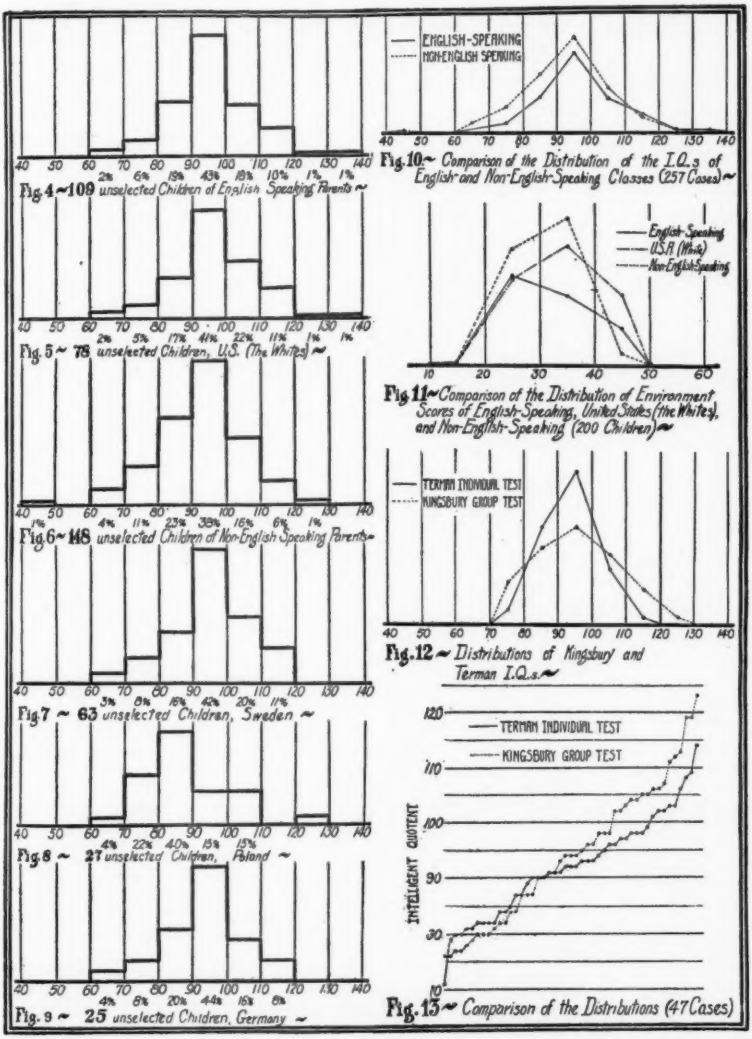


Fig. 4 ~ 109 unselected Children of English Speaking Parents ~

Fig. 5 ~ 78 unselected Children, U.S. (The Whites) ~

Fig. 6 ~ 148 unselected Children of Non-English Speaking Parents ~

Fig. 7 ~ 63 unselected Children, Sweden ~

Fig. 8 ~ 27 unselected Children, Poland ~

Fig. 9 ~ 25 unselected Children, Germany ~

Fig. 10 ~ Comparison of the Distribution of the I.Q.s of English- and Non-English-Speaking Classes (257 Cases) ~

Fig. 11 ~ Comparison of the Distribution of Environment Scores of English-Speaking, United States (the Whites), and Non-English-Speaking (200 Children) ~

Fig. 12 ~ Distributions of Kingsbury and Terman I.Q.s ~

Fig. 13 ~ Comparison of the Distributions (47 Cases)

Item III. Size of the Home, corresponding to Item III of the same. *Item IV.* Parental Conditions, corresponding to Item IV of the same. *Item V.* Parental Supervision, corresponding to Item V of the same. *Item VI.* Relatives, Friends, and Associates; a new item. *Item VII.* Child's Home Life; a new item. *Item VIII.* Neatness, Sanitation, Improvements of the Neighborhood, corresponding to Item I of the Whittier Scale for Grading Neighborhood Conditions. *Item IX.* Recreational Facilities, Institutions, and Establishments, corresponding to Items II and III of the same. *Item X.* Social status of the Residents and Average Quality of Homes, corresponding to Items IV and V of the same.

The maximum score of each of these items is 5 points, making a total of 50 points as the highest score. Of course there will sometimes be an exceptionally higher score; for, as the Guide to the Use of the Whittier Scale for Grading Home Conditions admits, "if an item is found which is entitled to a higher score than 5 points by comparison with the standard samples there is no reason why it should not be accorded 6 points or even 7 points, if in the judgment of the observer it is sufficiently superior to merit such marking."[4]

Eight items of the present scale for grading the environmental conditions, thus presented, are sufficiently explained in the Guides to the Grading of Homes and Neighborhood, referred to. We now, therefore, try to explain briefly the remaining two items which are in fact new, and to propose a tentative scale for them.

"Associates," explains J. H. Williams, "are persons with whom one comes in contact at home, in school, at work, on the street, in church, etc., and those with whom leisure time is spent. The associations may have arisen through accidental circumstances, or may be due to desired cultivation. It is generally conceded that character and development are closely related to associates."[5] A careful observation should be made of the relatives, friends, and other associates and members of the family, with whom the child comes into contact. The following 5 points may be mentioned as claiming special consideration in this connection: (1) character of the associates; (2) relations: activities of the individual in association with these persons; (3) attitude taken and interest shown by these persons; (4) examples given by these persons; (5) manner of spending leisure time.

We will next offer our tentative scale for grading this item of Associates, based on our actual study of 200 cases.

Samples Grading 5 points: (*a*) Three uncles and two aunts live near-by. They have average success as various kinds of skilled laborers, or as the wives of such. They keep their homes separately and seem enjoying a fine home life. Their relation to the *S*'s family is very cordial and intimate. They love the *S* and try earnestly to help in training him and building up his character. There are about 5 intimate friends. They are of good homes and possess fine character. They spend their leisure time together in playing, hiking, etc. Some of them are seen in the library in company with the *S*. So far as is known, there is no associate of questionable character. (*b*) Grandfather, a retired business man, still active, has a keen intellect, perspective and a well balanced character. He cares much for the welfare of the child; is accustomed to tell stories to *S* in the evening. The *S* loves him ardently. Several uncles and aunts live in near-by cities. They seem to enjoy fine home lives and are on good terms with the *S*'s family. Other associates of the *S* are made up mostly of his school-mates.

Samples Grading 4 points: (*a*) Grandmother, a gentle lady of normal intelligence, is very fond of the child. Several uncles live near-by, and are on good terms with the *S*'s family. They are of apparently normal intelligence and seem to have normal success in various occupations.

[4] *Op. cit.*, 11.

[5] Individual Case History Outline, *Jour. of Delinquency*, 5, 1920, 77 f.

(*b*) Grandfather and grandmother, apparently of rather keen intelligence and of good character. There is one aunt living in the family. She is a normally intelligent person, working in a down-town store. They are in good harmony. The *S*'s friends and other associates are schoolmates. None of them is known to have a bad reputation.

Samples Grading 3 points: (*a*) Three uncles live near-by. They are too busily engaged in their occupations to come to see the *S* often, though the *S* goes to see them. They are of apparently normal intelligence. School-mates make up the *S*'s other associates. (*b*) Grandfather and grandmother, rather ill-natured, but apparently on good terms with the rest of the family. One uncle lives near-by. He is a successful small store-keeper of a fine character. The *S* sees him often. Other relatives live in places rather remote, and do not come intimately into the life of the *S*. (*c*) An aunt, a divorcee, lives with the *S*'s family. She is rather vain and frequents theatres, but loves the *S* well. She is apparently on normal terms with the rest of the family. The friends of the *S* are recruited from among school-mates.

Samples Grading 2 points: (*a*) One uncle, a gambler and cheat, is living in the *S*'s home. Several relatives live in places more or less distant, and their relation with the family of the *S* can not be said to be intimate. (*b*) Although there are several uncles and aunts of the *S* living in the same town and adjoining towns, they are not on intimate terms with the family of the *S;* and the *S* does not even remember them. The other associates of the *S* are comprised of children living near-by. They organize a sort of gang, and are often said to be the authors of mischievous stunts.

By Home Life we mean the way and manner of the child's daily home life in which the character and future life of the child are moulded. Together with the school life it claims the foreground in influencing the child's development in various lines. We may especially note the following 5 points in this connection: (1) orderliness and punctuality; (2) cleanliness, fostering the habit of a clean thinking and living; (3) industriousness; (4) interest in studying and reading; (5) indulgence in amusements, the kind of amusements indulged in.

Samples Grading 5 points: (*a*) (13-year boy) Gets up at 7 a.m., goes to bed at 9 p.m. After school in the afternoon, runs errands or reads books. In the evening, plays ball and reads books. On Saturday, work. On Sunday, attends Sunday school. Home life is well regulated and kept clean. Sees moving pictures about once a month; likes those of cowboys. Likes school entertainments; loves reading books. The family keeps a library of about 300 books. Likes and plays indoor baseball, football and golf. Also plays violin. (*b*) (11-year girl) Gets up at 6:30 a.m., goes to bed at 8 p.m. The family speaks English. After school in the afternoon, plays and practises music lessons. In the evening, reads books and magazines. On Saturday, takes music lessons, plays, and "helps mother." On Sunday, goes to Sunday school in the morning, and plays or goes out with all the family in the afternoon. Sees moving pictures about once every other week; likes comic pictures, "not sad ones." Likes and plays baseball, basketball and skating. (*c*) (7-year boy) Gets up at 7 a.m., goes to bed at 8:30 p.m. Speaks English at home. After school in the afternoon, plays. In the evening, plays games and reads. On Saturday, plays and "helps Daddy and Grandpa." On Sunday, goes to Sunday school in the morning and plays in the afternoon. Sees moving pictures probably once or twice a year. Likes school entertainments. Also likes to play baseball and marbles, and to listen to victrola. Is well provided with educational as well as recreational materials. (*d*) (9-year boy) Gets up at 7 a.m., goes to bed at 8 p.m. Speaks English at home. After school in the afternoon, takes music lessons, does errands and plays. In the evening, reads books, and goes to "where mother tells me to." On Satur-

day, takes music lessons, works and plays and reads. On Sunday, goes to Sunday school and remains in the church during the morning service, and reads books and magazines or plays in the afternoon.

Samples Grading 4 points: (*a*) (14-year boy) Gets up at 7 a.m., goes to bed at 9 p.m. Speaks English at home. After school in the afternoon, plays ball. In the evening, plays and reads. On Saturday, works; and on Sunday, goes to Sunday school and plays. Sees moving pictures once a week. Likes music. Likes and plays baseball, basketball, etc. (*b*) (12-year girl) Gets up at 6:30 a.m., goes to bed at 8:30 p.m. After school in the afternoon, plays and practises music lessons; in the evening, plays. On Saturday, takes music lessons and plays. On Sunday, goes to Sunday school. Sees moving pictures about once a week. Likes minstrels and vaudeville. Plays basketball, skating, etc. (*c*) (7-year boy) Gets up at 7:30 a.m., goes to bed at 9 p.m. Speaks English at home. After school in the afternoon and in the evening, plays. On Saturday, plays. On Sunday, goes to church. Does not see moving pictures often. Likes marbles and skating.

Samples Grading 3 points: (*a*) (13-year boy) Gets up at 7 a.m., goes to bed at 9 p.m. Speaks English at home. After school in the afternoon, plays ball or does chores. In the evening, reads books or goes to theatre. On Saturday, plays. On Sunday, goes to church, and plays. Sees moving pictures about twice a week; likes pictures of "love and adventure and 'Diamond Dick.' " Hardly ever attends other entertainments. (*b*) (10-year girl) Gets up at 7 a.m., goes to bed at 8:30 p.m. Parents speak Polish at home. The home life is not well regulated, but runs about as follows: after school in the afternoon, plays, and in the evening, washes dishes; on Saturday, works; and on Sunday, plays or goes to see moving pictures. Sees moving pictures about once or twice a week. Hardly ever attends other entertainments. Likes kite.

Samples Grading 2 points: (*a*) (14-year boy) Parents speak Swedish at home. The home life is not regulated, but runs about as follows: gets up at 7 a.m., and goes to bed at 9 p.m. After school in the afternoon, plays or does chores. In the evening, plays. On Saturday, does chores, plays and goes to theatre. On Sunday, plays and goes to theatre. Goes to see moving pictures very often; likes love, adventure and comic pictures. (*b*) (13-year girl) Parents speak Swedish at home. The home is not regulated nor clean. The course of the home life runs about as follows. Gets up at 7:30 a.m., goes to bed at 8 p.m. After school in the afternoon, works, and in the evening, takes rest. On Saturday, works. On Sunday, goes out. Attends theatres and goes out frequently. Likes pictures of love.

Samples Grading 1 point: (*a*) (13-year boy) Non-English speaking parents; home life is not at all regulated, and the habit of the *S* is untidy and his manners and appearance are dirty. The home life runs about as follows, though not at all definite. Gets up at 7:30 a.m., goes to bed at 9:30 p.m. After school in the afternoon, plays. In the evening, plays or attends theatre. On Saturday and on Sunday, plays and wastes time. See moving pictures very often. (*b*) (9-year boy) Non-English speaking parents. Untidy habits. The *S* is, though young, obliged to help the parents by working; but the home life as such is not at all regulated nor clean, and only results in forming undesirable habits. Attends theatre very often with older associates.

We could study and grade 200 cases with this scale of the grading of environmental conditions. Now let us see the results thus obtained. The following Table shows the distribution of the environmental scores and their median and average scores, obtained through the use of the Grading Scale referred to.

TABLE IX

Distribution of Environment Scores, Median and Average

Score	*Number*
Above 40	18
30 to 39	94
20 to 29	87
10 to 19	1
Total	200
Median score	30
Average score	31

The coefficient of correlation between intelligence quotients and environment scores, thus obtained respectively by the Terman Revised Binet Test and the Scale for Grading Environment referred to, is not low, being .53.

The relation between intelligence and occupation may be studied in the following Table.

TABLE X

Relation of I.Q. and Occupations

	Kind of Occupation	*Number of Cases*	*Median*	*Average*
I	Business, office work			
	Office work	19	99	101
	Business	5	98	100
	Salesman	5	106	106
	Total	29	101	101
II	Transportation work			
	Driver	17	93	93
	Milkman	9	99	100
	Teamster	7	95	94
	Chauffeur	4	103	100
	Mail carrier	3	102	111
	Motorman	2	97	97
	Conductor	1	102	
	Total	43	98	97
III	Small Store Keeper and Helper			
	Laundry	13	86	86
	Tailor	9	91	90
	Grocery	5	104	104
	Butcher	4	95	101
	Bakery	4	86	89
	Photography	1	117	
	Greenhouse	1	102	
	Total	37	92	93
IV	Skilled Labor			
	Mechanic	20	94	94
	Carpenter	15	94	94
	Mason	11	90	91
	Painter	7	96	97
	Blacksmith	3	103	100
	Plumber	2	79	79
	Lather	1	76	
	Total	59	93	93
V	Unskilled Labor	52	89	88

VI	Miscellaneous			
	Janitor	17	90	88
	Peddler	4	64	61
	Gardener	3	82	87
	Total	24	85	84
VII	Widow			
	Housework	9	93	94
	Outside work (cook, maid)	4	100	100
	Total	13	98	96

From these figures we see that a decidedly high I.Q. is gained by the children whose parents are engaged in business or office work, and that a low I.Q. is for the children of those engaged in unskilled labor or peddling work. There are about 5 points of difference in I.Q. between skilled labor and unskilled labor, favoring the former.

V. Nationality and Environment

We have seen from the results thus far presented that the children of the English Speaking class stand higher in I.Q. than those of the Non-English Speaking class; especially, the children of the White United States citizens earned decidedly higher scores than any of other nationalities. Further, we have noticed that the higher I.Q. is attributed to the children whose parents are engaged in so-called brain or skilled work rather than to those whose parents are of other occupations. What, then, will be the relation of these three factors: Intelligence, Nationality and Environment? To get some light in answering this question we now turn our attention to the relation of nationality and environment.

The first point of which we have to take note in this connection is the relation of nationality and occupation. The Table presents this relation by showing the distribution of the number of persons with regard to these two points.

TABLE XI

Distribution of Nationality in Occupation

	Occupation	*U. S.*		*Others*	*English Speaking*	*Non-English Speaking*	*Total*
		White	*Colored*				
I	Business, office work						
	Office work	14	..	3	17	2	19
	Business	4	..	..	4	1	5
	Salesman	5	..	..	5	..	5
	Total	23	0	3	26	3	29
II	Transportation						
	Driver	6	..	2	8	9	17
	Milkman	2	..	3	5	4	9
	Teamster	1	..	..	1	6	7
	Chauffeur	1	..	..	1	3	4
	Mail carrier	2	..	..	2	1	3
	Motorman	2	..	..	2	..	2
	Conductor	1	..	..	1	..	1
	Total	15	0	5	20	23	43

III	Small Store						
	Laundry	..	..	..	..	13	13
	Tailor	..	..	..	..	9	9
	Grocery	4	..	..	4	1	5
	Butcher	1	..	..	1	3	4
	Bakery	1	..	..	1	3	4
	Photography	1	..	..	1	..	1
	Greenhouse	..	..	..	..	1	1
	Total	7	0	0	7	30	37
IV	Skilled labor						
	Mechanic	6	..	6	12	8	20
	Carpenter	7	..	4	11	4	15
	Mason	1	..	..	1	10	11
	Painter	..	..	3	3	4	7
	Blacksmith	..	..	..	..	3	3
	Plumber	1	1	..	2	..	2
	Lather	1	..	..	1	..	1
	Total	16	1	13	30	29	59
V	Unskilled labor	11	3	4	18	34	52
VI	Miscellaneous						
	Janitor	3	2	..	5	12	17
	Peddler	..	..	..	..	4	4
	Gardener	1	..	..	1	2	3
	Total	4	2	0	6	18	24
VII	Widow						
	Housework	2	..	..	2	7	9
	Outside work	..	..	..	..	4	4
	Total	2	0	0	2	11	13

From these figures we see that the more favored occupations are taken by the English Speaking class, especially by the White citizens of the United States; and that, on the other hand, the Non-English Speaking class is mostly left for the less favored occupation. Whether this is because of the inherent difference of intelligence or the environmental difference of opportunity we can not so readily tell. We may here give one more Table, showing the distribution of the environment scores in the main different groups of nationalities.

TABLE XII

Distribution of Environment Scores

Nationality	*Number of Cases*	*Median*	*Average*
United States	45	33	33
Other English Speaking	26	29	29
Total English Speaking	71	32	32
Total Non-English Speaking	129	30	30
Grand Total	200	30	31

The same relation from a somewhat different angle may be seen in Fig. 11, which presents the comparative study of the distributions of environment scores of 200 unselected children between the English Speaking and Non-English Speaking classes and the White citizens of the United States. We see that the United States White citizens enjoy the most favored environment, and that the Non-English Speaking class is less favored on this point.

VI. Conclusion

In concluding the present Study, we may especially note the following points.

(1) Both the median and the average scores of the intelligence quotients of the total school children (257) is 93.

(2) The English Speaking class scores higher than the Non-English Speaking class, with a difference of 4 points in both the median and average scores.

(3) Those whose parents are engaged in so-called brain and skilled work score higher than those whose parents are of other occupations. To put this relation in terms of the average I.Q., we say that there is a difference of 13 points between business and office work and unskilled labor, and that there is also a difference of 5 points between the class of skilled labor and that of unskilled labor.

(4) The English Speaking people are engaged more in the occupations of "brain and skilled" work and less in unskilled labor than the Non-English Speaking class.

(5) The English Speaking class gets higher environment scores than the Non-English Speaking class, the difference being 2 points.

(6) The coefficient of correlation between the intelligence quotients and the environment scores is not low, being .53.

(7) From these facts we may conclude that there exists a rather close relationship between intelligence, nationality and environment. High I.Q., high environment score, and brain work go with the people of the English Speaking class, and the reverse is true with those of the Non-English Speaking class.

Appendix I: Kingsbury Test and Terman Revised Binet Test in our Study

The Kingsbury Group Intelligence Test was used by Mr. Walker, the Assistant Superintendent, in testing the intelligence of the children of the Washington School in May and Dec., 1920. Some of the results are found still useful in checking up the present results which we get by the use of the Terman Revised Binet-Simon Individual Test. Here we take up the correlation of the Kingsbury Test and the Binet Test. As but a few of the results obtained in May, 1920, are still applicable, we take here only those of the Dec. test.

The following Table shows the distribution of I.Q.s, median and average scores of 47 children, tested by the Kingsbury test.

TABLE XIII

Distribution of I.Q.

I.Q.	*Number*
120	1
110	5
100	10
90	14
80	11
70	6
Total	47
Median	94
Average	94

The coefficient of correlation between the I.Q. of the above cases tested by the Kingsbury test and those obtained by the Binet test is .47.

The same relation may be studied in Figg. 12 and 13, which present graphically the comparison of the distribution of intelligence quotients of 47 children between those obtained by the Kingsbury test and those of the Binet test, Fig. 13 being the study of individual case comparison.

In this connection we may look at the different scores according to the main divisions of nationality although the study made by this Kingsbury test does not include a sufficient number of cases to give any authoritative result.

TABLE XIV

Mean and Average Scores of 47 Children Made by the Kingsbury Test, According to the Main Divisions of Nationality

Division	*Number of Cases*	*Median*	*Average*
English Speaking	15	94	96
Non-English Speaking	32	95	94
Total	47	94	94

Appendix II: The Problem of Sex

Of the total number of 257 children of our study, 145 are boys and 112 are girls. The following Table shows the distribution of intelligence quotients among the two sexes.

TABLE XV

Distribution of I.Q.s Between Sexes

	Number		
I.Q.	*Boys*	*Girls*	*Total*
130		1	1
120	1	1	2
110	11	9	20
100	26	20	46
90	62	41	103
80	25	30	55
70	13	8	21
60	6	2	8
50			
40	1		1
Total	145	112	257
Median I.Q.	94	93	93
Average I.Q.	92	93	93

From these figures we do not see any significant difference to be mentioned between the two sexes.

DISCUSSION

C. SPEARMAN, *The Nature of 'Intelligence' and the Principles of Cognition*, 1923.

The author of this volume is the well-known psychologist of the University of London whose work in the field of mental measurements has led him to the interpretation of intelligence in terms of a general and purely quantitative factor to which specific and variable factors are added. The rationale of testing is accordingly based upon the effect of pooling specific tests, thereby bringing out the general factor which underlies them.

In this volume Spearman attempts to lay the foundations of a scientific psychology which shall determine the principles upon which intelligence operates and thus discover the nature of intelligence itself.

Part I, embracing two chapters, deals with the historical and critical aspects of the problem, attention being chiefly given to the views of Binet and those who followed him in perfecting the technique of testing. After first reducing intelligence to *judgment*, Binet proceeded to add tests of memory, language, and sensory intelligence, and finally modified his original view by admitting four criteria of intelligence—*comprehension*, *invention*, *direction*, and *censorship*—all of which are pooled in the tests which now bear his name.

Recent definitions of intelligence in terms of the tests are even more wanting in agreement than Binet's own divergent views. This fact was instanced in the symposium on the subject printed in the *Journal of Educational Psychology*, 7, 1921, where the definitions of various authorities are vaguely stated in such terms as "adaptability to new situations," "acting effectively," making "good responses," etc. Spearman also refers to Bobertag's view that the technique of testing does not require any definite answer to the question, what it is we are testing; an opinion with which Spearman finds himself in complete disagreement. The book at hand may therefore be regarded as an attempt to lay the foundation for a definition of intelligence in terms of a psychology of cognition.

The defect of modern psychology, according to Spearman, is that its experimentation has not led to significant generalizations; such generalizations as it has employed having remained empty for want of experimental substantiation. The only general law which can be evoked by psychology is the law of association, and this has suffered many diverse interpretations. Spearman proposes to remedy this defect by "clear thinking, ultimate laws, and an appropriate experimental procedure." Beginning with sensory experience, which in the original conscious process is merely "lived" or "undergone," the ordinary percept includes far more than sensory stimulation as a mere state of sentience. Even sentience is attained only after a transition which, in the case of vision, involves (1) the material thing; (2) the ether waves; (3) the chemical processes of the eye; (4) a current in the perceptual nerves; (5) the chemical processes of the sensorium; and (6) the passage from matter to mind—all occurring before sentience itself can be "lived" or "undergone." Furthermore, Spearman remarks that stages (3), (4) and (5) are each qualitatively independent of the stages which precede them, and hence "the eventual effect of the material thing on consciousness is barred three times over from any likeness to that thing itself."

Granted sentience, however, what are the means whereby we pass on to the percept? This question is answered by the statement that "any lived experience tends to evoke immediately a knowing of its characters and experiences." Here we have Spearman's first principle of the *apprehension of experience*. The "form" which experience thus takes implies "some sort or other of what may be called 'material,' " but whereas the

"form" is only the aggregate of those attributes of the occurrence which remain in all instances similar, the "material" is composed of such attributes as may vary from one instance to another.

The analysis of "material" includes: (1) sentience with its four "characters" of quality, intensity, spatiality, and temporality; (2) affection; (3) cognition; (4) conation; and (5) the direct experience of the ego; all of which are experienced by direct "evocation of knowing, and so on." "Form" in its turn involves the characteristics of *propositional import*, *belief* and *insight*, *coherence*, and *unit-processes*.

These, then, are the characters of experience, material and formal, which are immediately evoked, and which, when taken together, constitute the consciousness of experiencer, experiencing, and experienced.

Two comments are here suggested. (1) Cognition and conation seem out of place as contents of consciousness, and without a reference to content the precise significance of "materials" is equivocal. (2) The formal aspects of experience in terms of the four categories named are logically unconvincing, because "coherence" and "unit-processes" are so like, whereas "propositional import" and "belief and insight" are so different.

Passing on, however, to Spearman's second principle, the *eduction of relations*, we find this principle stated in the following terms: "The mentally presenting of any two or more characters (simple or complex) tends to evoke immediately a knowing of relation between them." As a corollary it is stated that relations once apprehended may thereafter act as fundaments for new relations. Relations as such possess "character" just as the original data of apprehension possess "character." Relations are then divided into two classes: (1) *real* relations, which include *attribution*, *identity*, *time*, *space*, *cause*, *objectivity*, and *constitution;* and (2) *ideal* relations, such as *likeness*, *evidence*, *conjunction*, and *intermixture*.

It would appear that, in addition to our powers of apprehension, we possess a peculiar mental power of *eduction* which furnishes the mind, not only with the relations of one thing and another, but also with new "materials" and new "forms" of apprehension. Eduction is thus opposed to apprehension as a distinct type of awareness.

In a paper entitled "Mental Activity and Conscious Content," published several years ago,[1] and also in *An Introduction to General Psychology*[2], a similar interpretation of cognition has been advanced by the reviewer. The distinction I then drew between the immediate eduction of relations as they subsist between contents or "characters," and the abstraction of relations as new "materials," called *notions*, does not appear to have been essentially different from Spearman's provision for new fundaments, supplied by relations once apprehended.[3]

The classification of relations then proposed by me followed a suggestion of E. Dürr in his revision of Ebbinghaus' *Psychology;*[4] namely, two main classes—one of *particularity*, in which the object or character is apprehended in a dichotomous relation with the rest of experience, the other embracing relations of *likeness* and *difference*, *equality* and *identity*, in which at least two objects or characters are related to one another.

The scheme was frankly logical, though I now believe it possible to indicate psychological data from which these two fundamental principles of logical classification can be derived; thus, *particularization* is given in the apprehension of a "figure" upon the "ground" of experience,[5] whereas relations of likeness and difference are phenomenally determined by the characteristic dimensions or aspects of the figure apprehended. Particularization is therefore a more primitive type of *eduction*—to employ

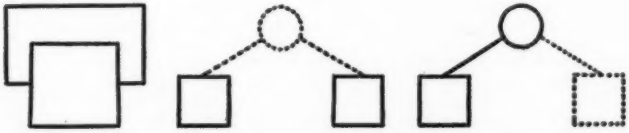
[1] *Philosophical Essays in honor of James Edwin Creighton*, 1917, 290 ff.
[2] 1914. [3] Cf., especially, *General Psychology*, 93 f. [4] 2, 1911, 279.
[5] Cf. E. Rubin, *Visuell wahrgenommene Figuren*, 1921.

Spearman's term—than is the comparison of characters in pairs, since the latter becomes possible only when the experiencer is able, as it were, to hold two things in mind at once.

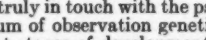
While I readily admit that my own attempt to interpret cognition rested more heavily upon the logic of classification than upon the psychology of cognitive experience, Spearman's principles do not appear to be any less free of contamination. Consequently his list of relations suggests neither rigorous logic nor psychological observation. Instead, the list leaves us without knowledge as to the method of selection, so that it might conceivably be more or less extended than it is. Furthermore, logic has its virtues, despite the danger of confusing it with psychology, the chief among them being the classification of concepts so as to define each term distinctly from every other term. Logic also demands that, taken together, these concepts shall exhaust the possibilities within the limits which the class has set. One can not be sure that Spearman's *real* and *ideal* relations satisfy these conditions, whereas *contradictories*, *likenesses*, and *differences* do.

Passing on to Spearman's third principle—*the eduction of correlates*—we note the statement that "the presenting of any character together with any relation tends to evoke immediately a knowing of the correlative character." Here we have the final stage of eduction. Viewed together, the three principles are graphically represented by the following figures:

I II III



Though Spearman makes surprisingly little use of genetic modes of interpretation, it is fairly obvious that his third principle follows his second, since a known relation is necessary to the evocation of an unknown correlate. In other words, the relation now serves as a category under which the correlative of the given term makes its appearance.

Other figures might be devised which would bring these facts of logic more truly in touch with the psychological data of observation. Regarding a datum of observation genetically—both with respect to its origin in the earliest stages of development, and also (with certain modifications) as it appears for the first time in any mind—its initial stage might be represented as the appearance of a vague figure (A) upon the ground of consciousness (not-A): 

. This ill-defined object of experience is the "lived" or "undergone" with a degree of articulateness sufficient, at least, to provide an accent lacking in the less articulate ground from which it emerges. Furthermore, this emerging datum of experience is not merely the counterpart of the stimulus of response, for it also embraces the response itself in so far as this is "lived" or "undergone." At its lowest level, apprehension must therefore be something more than a static presentation in sensory terms, since it is also a dynamic process with a temporal course. The analysis of such a vaguely defined phenomenon of consciousness can obviously be undertaken only at a much higher level of cognition than is implied at this low stage of development. But can we not assume for it the qualities of urgency which as adults we feel in moments of vague desire in the course taken to satisfy this desire? The direction of behavior,

with its all-or-none characteristic of persistency until the desired end is achieved, enables us to underwrite such an experience in psychological terms of sentience and affection. It also enables us to apply the logic of dichotomy to the A of our scheme which emerges over against the level of inarticulate sentience and affection that we have called the ground of consciousness, or not-A.

The next stage in this procedure would be the definition of A's contour—a definition which is conditioned both by the inherent nature of A and likewise by the nature of the receiving and behaving organism. But object and organism must not be too sharply differentiated, because at this level we are dealing with a total response; consequently the apprehension of A is part and parcel of the state of receptivity and response. It is important, however, that the varying susceptibilities of the objective and subjective aspects of apprehension should be noted; for although a clearly defined circular object in the field of view might be overlooked, such an object would nevertheless be more readily apprehended than a vaguely circular glow in the darkness.

The definition of contours is conditioned both by an appropriate objective form and also by an appropriate subjective readiness: and the likeness of these two is so intimate that one is led to question Spearman's previously noted statement that the chemical process of the eye, the current in the perceptual nerves, and the chemical processes of the sensorium constitute three stages, each qualitatively independent of the material thing and of its medium of transmission to the eye—a statement which leads him to conclude that "the effect of the material thing on consciousness is barred three times from any likeness to that thing itself." In terms of Spearman's analysis, his conclusion is inevitable; but this analysis is not the only one possible, since it is conceivable that the material thing itself, as well as the physiological stages which intervene between it and consciousness, each and all possess *formal* characteristics of an identical order. In other words, if the material object, the physiological configuration of nervous response, and the perception, or seen object, were *formally identical*, a definition of contour would be jointly conditioned by the structure of the object perceived, by the maturation of previously established conditions of readiness in the sensorium, and by the general attitude of the whole psychophysical organism at the time of apprehension.

What this definition of contour *does* to the object which was not done at the first and less articulate stage of emergence is contingent upon observable data within the configuration of A, toward which more or less discrete and differentiated modes of behavior are directed. Thus, to return to our scheme, we have not only A and not-A, as the terms of our configuration, but also the a^1 and a^2 dimensions of A, which, being the "characters" of the contour, supply the basis for all comparison and all discrimination. The relation which Spearman *educes* is therefore a feature of the configuration. Likewise the eduction of correlates is but the completion of a figure by a supplementation of missing members: $\underline{\text{not-A}}\,\underline{a^1\,A\,a^2}\,\underline{\text{not-A}}$.

I submit this scheme as a substitute for the one advanced by Spearman in the belief that it meets the conditions imposed by logic without using the terms of logic as if they were themselves psychological data.

After presenting his three principles of apprehension and the eduction of relations and correlates, Spearman advances five quantitative principles which govern the general factor of intelligence.

I. With respect to mental energy, "every mind tends to keep its total simultaneous cognitive output constant in quantity, however varying in quality."

II. With respect to retentivity, "the occurrence of any cognitive event produces a tendency for it to occur afterwards;" in connection with which it appears that "cognitive events cease more gradually than their (apparent) causes."

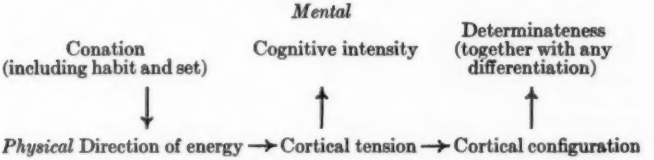
III. With respect to fatigue, "the occurrence of any cognitive event produces a tendency opposed to its occurring afterwards."

IV. With respect to conative control, "the intensity of cognition can be controlled by conation."

V. With respect to primordial potencies, "every manifestation of the preceding four quantitative principles is superposed upon, as its ultimate basis, certain primordial but variable individual potencies."

These quantitative principles, Spearman goes on to say, bring about the three processes of *reproduction*, *disparition*, and *clearness-variation*, which are " 'anoegenetic' in the sense that they neither have the nature of self-evident propositions nor generate any new items in the cognitive field."

The discussion then leads to a definition of clearness in terms of *intensity* and *determinateness*, in the course of which it is pointed out that the determinateness of cognition is slower than the intensity of cognition. Certain experiments by the author on visibility are cited which seem to indicate three distinct temporal curves for intensity of sentiency, intensity of cognition, and determinateness of cognition; the first of these attaining its maximum after about .2 sec., the second after .5 sec., and the third after 1.0 sec. The correlation of these with their physical counterparts is indicated by the following scheme:


Mental
Conation (including habit and set)
Cognitive intensity
Determinateness (together with any differentiation)
Physical Direction of energy → Cortical tension → Cortical configuration

This scheme fits well into the general setting of our own constructive suggestions, if mere sentience is made equivalent to what we have called the undifferentiated ground of consciousness. Cognitive intensity, then, arises with an appropriate cortical tension which occasions the emphasis of A above not-A, without, however, defining A's contour. For definition, a "cortical configuration" is requisite whose counterpart is a more definitely articulated figure of consciouness, the dimensions or characters of which are differentiated. In a word, *determinateness* is equivalent to what we have called the definition of contour.

The essential difference between Spearman's interpretation of cognition and the one here contrasted with it is the difference between the conception of an aggregate of materials and forms, which can be supplemented with new materials and new forms by *eduction*, and a conception which rejects the aggregate as an observed datum of experience, and regards cognition, and hence intelligence, as processes involving constructive membership. The apprehended unit is assumed from the start to be an organized whole, although it is one which is always capable of further organization through further definition of its members. Definition, however, is accomplished neither by the associative principle of accretion, nor by the alien and somewhat mysterious act of eduction, but solely by the integrative principle of organic membership inherent in the factual data themselves.

When Spearman emphasizes the surprising validity of Ebbinghaus' completion test as still one of the best, though it is one of the earliest single tests of intelligence, he is at the same time emphasizing the fact that intelligence strives for completeness by closing the gaps which otherwise

render experience incomprehensible. But is not comprehension itself a membered whole the contour of which is complete and definite because its internal structure is complete and definite?

What then is the nature of "intelligence?" An answer to this question would be that the nature of intelligence is revealed by the nature of the contour of experience. Whether the mode of experience be extended as a picture to the eye, or drawn out as a melodic sequence to the ear, or knit together in a continuous course of movement as a rhythmically balanced, economical response, in all cases we are defining the contour of a figure, with variations of definition which contribute degrees of intelligence. But always there is a perceptual aspect which can be more or less definitely objectified, and always there is a movement of response incapable of the same degree of determinateness as to the successive features of the movements involved.

Two questions remain. (1) Does this alternative suggestion answer Spearman's demands for "clear thinking, ultimate laws, and an appropriate experimental procedure?" Only further investigation can answer, but at least it may be said that the laws of configuration, so far as they have been derived, are a direct product of experimentation, whereas the laws of evocation which Spearman advances impress one as a somewhat belated formulation of the now obsolete psychology of "imageless thought." (2) Has Spearman's or any other attempt to define "intelligence" any significant bearing upon the improvement of the technique of mental measurements? This, too, is a question which will be answered, not from the arm-chair, but from the field of experimental testing.

R. M. OGDEN

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BOOK REVIEWS

(1) *The Education of Gifted Children.* By LULU M. STEDMAN. Yonkers-on-Hudson, The World Book Co., 1924. pp. vii+192. One of the "Measurement and Adjustment Series," edited by Lewis M. Terman. Price $1.80.

(2) *The Unstable Child: An Interpretation of Psychology as a Source of Unbalanced Behavior in Abnormal and Troublesome Children.* By FLORENCE MATEER. New York, D. Appleton & Co., 1924. pp. xii+471.

Of all literature on applied psychology the best is that which reports the results of actual trials, carefully planned and systematically carried out, or the observations of competent observers with ample material for study. The two books above mentioned belong to this excellent type.

(1) Miss Stedman, the organizer, and training teacher in charge, of the "Opportunity Room" of the training school of the Southern Branch of the University of California, reports the results of an experiment running through five or six years in giving exceptional opportunities to exceptionally able children in a special class in which the lock-step of the ordinary school system was discarded and the children worked with great freedom and largely on their own initiative. The group was small of course and their teacher no doubt exceptionally qualified. They were of chronological ages from 9 to 13, with high I. Q.'s (mostly over 140), and were doing work corresponding to the upper grammar school grades or the junior high school. Seventeen cases are described in some detail, five or six of them with a chapter each, and make interesting reading.

The course in the "Opportunity Room" was planned, not with a view to rushing the children at the rapid pace, which they were easily able to take, through the ordinary curriculum, but rather with a view to holding them within a reasonable distance of their fellows of like chronological age, while their powers were fully engaged and their interest held by an enriched curriculum. The fears of critics that segregation would lead to conceit and that a fuller course would mean over-work both proved happily groundless. The children liked it and accomplished marvels, as the samples of their literary work and musical compositions abundantly testify. No one having to do with the teaching of superior children will want to miss the reading of Miss Stedman's account.

(2) The 21 chapters of Dr. Mateer's book are divided into two parts, of which the first treats of the psychological clinic and the fine art of conducting it successfully, and the second gives the results of case studies, 350 or more in number, chiefly of young delinquents referred for study by the Ohio courts. The central point of the first part is the absolute necessity of getting away from the notion that a bare I. Q. is an adequate basis for the diagnosis of the case of a problem-child and of substituting for it the conviction that the only adequate basis is a thoroughly individualized study, making use of many methods and extending to all the aspects, both inner and outer, of the child's life and behavior. The central point of the second part is the contention, strongly supported by evidence, that the cause of delinquency in children in the vast majority of cases—Dr. Mateer would perhaps say in all—is some inadequacy in the functioning of such mental capacity as the child has, some deviation in his mental or physical organization which makes it impossible for him to respond normally; or to put the same thing more epigrammatically: "There is no such thing as a bad boy or girl. Either the child does not know any better or else he cannot help it." This deviation is what Dr. Mateer calls "psychopathy"—an intermediate condition grading out of the normal on one side and into the psychotic on the other.

For the valuable practical suggestions of Part I, and for the case records of Part II and the inferences drawn from them the reader will wish to consult the original, but one observation of the author's, to which a chapter is devoted in Part II, is worthy of special mention. Dr. Mateer has observed that children with congenital syphilis respond to the various test situations in a uniformly characteristic manner,—so characteristic, in fact, that she has been able in a number of cases to make a diagnosis of congenital syphilis by this means alone, in the absence of the ordinary physical signs and in advance of a Wassermann test. While the general reliability of such a method has yet to be confirmed on a large scale and by other observers, there seems no inherent impossibility about it in view of the characteristic mental symptoms of general paresis.

The book closes with a bibliography of 69 titles and an index. It is a work which may be commended to all who are interested in the development of clinical psychology to something nearer its full possibilities than it has yet attained.

E. C. S.

The Child: His Nature and Needs: A Survey of Present-Day Knowledge Concerning Child Nature and the Promotion of the Well-Being and Education of the Young; A Contribution of the Children's Foundation. Prepared under the editorial supervision of M. V. O'SHEA. pp. ix+516.

This volume is, as its sub-title indicates, a comprehensive general statement of present-day knowledge, published and distributed by the newly organized Children's Foundation at Valparaiso, Indiana, of which Mr. L. E. Myers is the patron. The material is arranged in three major sections dealing respectively with child nature, child care, and education. The work is a cooperative one and the names of the contributors guarantee a high level of excellence.

To Part I Professor B. T. Baldwin contributes a chapter on Bridging the Gap between our Knowledge of Child Nature and the Training of Children; Professor Mary T. Whitney on The Child's Instincts and Impulses; Professor W. F. Dearborn on The Development of the Intellect in Childhood and Youth; Dr. H. Neumann on The Child's Moral Equipment and Development; Professor F. E. Bolton on Social Traits; and Professor E. A. Kirkpatrick on Language, Drawing and Music.

In Part II, Professor H. H. Goddard writes on Bridging the Gap Between our Knowledge of Child Well-Being and our Care of the Young; Dr. W. R. P. Emerson on The Relation of Nutrition to Mental Development; Dr. W. A. White on Nervous and Mental Hygiene; Professor C. E. A. Winslow on Sense Defects; Dr. W. Healy on Delinquency; Professor A. Gesell on Intellectually Inferior Children; Professor Leta Hollingworth on Intellectually Superior Children; and Dr. W. S. Hall on The Adolescent Period.

In Part III an introductory paper is furnished by Commissioner J. J. Tigert, and five chapters on modern educational tendencies and ideals by Professor M. V. O'Shea. The work closes with nearly 20 pages of select bibliographies of sources in English on matters treated in the several chapters, a section of short biographical sketches of the contributors, and a full index.

It is hardly to be expected that in a work of this character anything of great novelty should be offered—the purpose of the work is rather a compendious statement of things already known—but it should, nevertheless, prove useful as a handy means of orientation to beginners in the study of children and as a book for reference and collateral reading for college classes in education.

E. C. S.

A Magician Among the Spirits. By HARRY HOUDINI. New York, Harper and Brothers, 1924. pp. xix, 294 and 13 half-tone cuts.

Houdini writes of Spiritism in this book, as the title indicates, from the point of view of the professional magician, a thing which he by training and interest is particularly well qualified to do; for, as he tells us in the introduction, he has devoted 30 years to the study and investigation of occult phenomena. Very early in his career he identified himself with the movement, "joining the rank and file and holding séances as an independent medium to fathom the truth of it all." Since then the examination of these phenomena has been his life's avocation. Though in all his search and in all his investigation he "has not found one incident that savoured of the genuine," his interest has never flagged. He writes earnestly and sympathetically, and with an openmindedness and scientific poise that are remarkable for a man of his experiences.

The first part of the book is devoted to biographical sketches and the examination of the "claims" of the great leaders in the cult. Houdini considers in the order named the Fox sisters, the Davenport brothers, Daniel Dunglas Home, Eusapia Palladino, Ann O'Delia Diss Debar, and Henry Slade. With the exception of an account of his friendly relations with Ira Davenport, which shows that this so-called disciple of Spiritism had no belief in it, and of the publication of a letter from the medium Remigius Weiss, which contained Slade's written confession that all of his "pretended Spiritualistic manifestations were and are deceptive, performed through tricks," Houdini gives nothing new. He merely reviews in an interesting and entertaining manner what has already been published about these persons.

Though it is patent that the author could not consider all the mediums of first rank, that he had to pick and choose to keep his book within due bounds, he nevertheless, in the reviewer's opinion, should have added at least one name, Mrs. Piper's, to his list. She was a medium of a different stripe from any that he considers, her claims are as great as theirs, and her position among the ranks of the "true believers" is probably more secure.

In the chapters which follow the biographical sections, Houdini explains the technique of slate writing, of spirit raps, of levitation, and of spirit photography. A chapter is devoted to Sir Arthur Conan Dyole with whom Houdini maintains a cordial friendship, and the credulity, naïveté, and childlike faith of this author are clearly displayed. The next chapter is given to the consideration of ectoplasm; Houdini tells of his experiences with Mlle. Eva C., a virtuoso of the art of regurgitation; and of d'Albé's exposure of Kathleen Goligher of the "Goligher Circle", made famous by the writings of the physicist W. J. Crawford. A moralizing chapter is devoted to the by-products of Spiritualism, and specific instances are given of "the suffering, losses, misfortunes, crimes and atrocities of which it is the underlying cause and must bear the primary responsibility." One of the most interesting chapters of the book is that dealing with the methods employed by mediums to obtain information regarding their "clients." Houdini shows that this is not so much a matter of "lucky hits" or of "fishing," though both are taken advantage of, as it is of the systematic way in which they set about to gather it. The extent to which the "will to believe" is necessary is shown in the chapter, "What you must believe to be a Spiritualist."

Two chapters deserve particular mention: "Investigations—Wise and Otherwise," and "Magicians as Detectors of Fraud." In the first of these Houdini tells of the complications surrounding an investigation and outlines the prerequisites that investigations should have. He then illustrates his remarks by reference to specific investigations,—good and bad. His failure to refer to the *Experiments in Psychical Research at Leland Stanford, Jr., University* is surprising; for of all the investigations that have been

undertaken this work of Coover's without doubt takes first rank. In the second chapter he shows that the magician is not, by virtue of his profession alone, competent to meet the chicanery of a skilled medium, and he illustrates the magician's fallibility by citing instances in which some of the greatest performers have been "taken in." The book closes with a short chapter in which Houdini summarizes his findings, and with 8 appendices which deal with special topics.

The book is interesting throughout and it is one that the novice in Spiritism should read.

K. M. D.

Nervous and Mental Re-education. By SHEPARD IVORY FRANZ. New York, The Macmillan Co. 1923. pp. ix, 225.

Re-education, for Franz, involves the same principle as education—habit formation. There is, however, this difference: in the original habit the instinctive tendency has been used as a basis for the acquirement of the habit, but in re-education the original instinctive tendencies cannot be so utilized. The problem is, therefore, to find a new foundation for habit and to develop the new reaction upon that basis. In most cases this is not difficult, as the ambition to be socially and economically independent is usually found. The methods of re-education may be applied both to the training of bodily reactions, or the acquirement of new co-ordinations, and to habits of thinking.

The scope of the work is as follows: Part I treats of the Basis and General Concept of Re-education; Part II, of the Principles of General Re-education; and Part III, of Neurological and Mental Adjustments.

Although the programme is broad in scope, the author is concerned largely with the neuro-muscular response—the type of readjustments necessary in such diseases as anterior poliomyelitis, tabes dorsalis, the cerebral paralyses, etc. Here the problem is the building up of new motor co-ordinations. One chapter alone is devoted to the psychotic, which includes the neurasthenic, the psychasthenic and the hysteric. In this group, the patient must have insight into his own condition; he must desire to get well and must possess self-confidence in order to benefit from training. Here the attention has to be centered upon the social activities which in the organic group do not need especial emphasis.

The writer's theory of education as habit formation is applied consistently throughout, but the reviewer is impressed with the distinction between the organic and the psychotic groups. Can education, or re-education, be limited to the formation of habitual responses? Franz cites this example as illustrating the formation of habit. "Experiments with cats show very well that the same situation may result in different habits. A good example of this is with respect to the activities of different cats in a box, the door of which can be opened by moving a string which is attached to a latch. One cat learned to do this by arching its back and by rubbing against the string, thus exerting enough pressure to move the latch. A second animal acquired the habit of biting and pulling the string, and a third cat clawed and pulled the string. All these are motor habits. Each animal has learned to move in a special way when it received certain stimuli (the sight and feel of the particular box) and the special habit which is produced depends upon the instinctive reactions of the particular animal." The fact that the same stimulus does not call forth the same response is attributed to differences in the instinctive reactions of the animals. From the standpoint of Köhler's learning experiments with animals, the reviewer would think that the problem appeared differently in the course of the solution to each animal; that is, each animal adopted a different means of arriving at the desired goal. Thus the different habitual responses that the animals acquired would be attributed, not to differences

in instinctive equipment, but to differences in the individual solution of the problem. There is no evidence that would point to the fact that the animal is originally equipped to deal in a particular manner with such a puzzle box. The exercise of 'intelligence,' in the sense in which Köhler uses the term, would bring about these different achievements and would account for the habitual responses established as a result of these achievements. The solution of the educational problem would seem to point, not in the direction of the acquiring of habitual, stereotyped reactions, but in the direction of training so that the individual would be able to act intelligently —to exercise his initiative in the solution of problems.

In retraining neuro-muscular responses, the difference between the two concepts of education is not so apparent; with the psychotic, however, the difference is emphasized, as we are here dealing with disturbances of judgment, with the inability of the individual to perceive and to react as normal individuals do. In so far as re-education of the mentally disturbed is possible, the reviewer would suggest that training in 'intelligence' is requisite—training which permits the patient to seek out desired goals, the accepted ones of social life, and to modify his conduct toward these goals.

From a practical point of view, the work is very useful, in that it represents the results of long and successful work in this field by Dr. Franz. To the physicians and educators who deal with the physically and mentally handicapped, the book is heartily recommended.

Applied Psychology. By BERNARD C. EWER. New York, The Macmillan Company. 1923. pp. viii, 480.

The author of this text endeavors to steer a middle course between "elaborate theory and experimental investigation, characterized by technique which is highly refined and to some extent unintelligible except to the specialist" and "popular psychology, which presents little that is of practical value, since it lacks the scientific foundation and formulation necessary to make it reliable." He realizes that bizarre claims have been made for this study, that over-confidence and charlatanism have often characterized the field. Applied Psychology is, for the author, "the statement of psychological principles which have value with reference to the practical interests of mankind. It includes also the experimental method of solving practical problems."

Chapters II, III, IV are devoted to the critical statement of certain principles: Analytic Observation, Scientific Explanation, Mechanical Control, Experiment, Subconsciousness and Suggestion. Ewer appreciates the hazy nature of the usual concepts and cautions the reader against a too ready juggling of popular terms. To quote by way of illustration: "Freudianism seems to the writer to be a mixture of scientific observation and explanation with crude metaphysics and deceptively imposing terminology . . . . Some of the doctrines appear to be sheer fancy or the dignifying of insignificant facts by impressive nomenclature."

The topics of the Measurement of Intelligence, Fundamental Factors in Education, the Learning Process, Intellectual Efficiency, Control of Emotion and the Will, Psychotherapy and Suggestion, Vocational Selection, Industrial Psychology, Advertising and Salesmanship are treated in the remainder of the book. With the exception of the chapter on Learning, these topics are adequately treated. The psychology of learning is very fundamental for an applied psychology—in fact, one might say that it is the core around which the whole subject should be constructed. Here, however, we are given descriptions of the kinds of learning and of habits; and these do not solve the important problem: *How* does the individual

learn? In the answer to this question, and not in statistical data, interesting as they may be, is the solution of this problem and of the problem of formal training to be found.

In the opinion of the reviewer, this text is, in general, a clear, sane and common-sense presentation of the subject. In these respects it is superior to other works of the kind in English.

Cornell University SETH WAKEMAN

Evolution and Religion. By HENRY FAIRFIELD OSBORN. New York, Charles Scribner's Sons, 1923. pp. 21. Price 75 cents.

This booklet is a reply to an article by W. J. Bryan in the *New York Times* of Sunday, Feb. 26th, 1922, and appeared in the same paper on the Sunday following. What can one do with such a subject in the cramped space of a Sunday newspaper article? Little enough! But what could be done Dr. Osborn has done and has had, of course, no difficulty in showing that evolution and orthodox Christianity are entirely compatible and have been even from the time of St. Augustine.

Giving Your Child the Best Chance. By RUTH DANENHOWER WILSON. Chicago, A. C. McClurg & Co., 1924. pp. 196.

This little book has been prepared to give to the parent, face to face with the practical problem of steering his own children through their mental and moral troubles, some notion of what students of genetic psychology and psychoanalysis have found that would be helpful to him. Mrs. Wilson is evidently familiar with the best sources in English and, what is still more important, knows something at first hand about children. The material is handled simply and readably, four of the nine chapters having earlier stood the test of publication in one of the popular magazines.

E. C. S.

(1) *Herring Revision of the Binet-Simon Tests. Examination Manual: Form A.* By JOHN P. HERRING. Yonkers, World Book Co. 1922. pp. 56.

(2) *A Point Scale for Measuring Mental Ability. 1923 Revision.* By ROBERT M. YERKES and JOSEPHINE CURTIS FOSTER. Baltimore, Warwick and York. 1923. pp. 219.

(3) *Intelligence Measurement: A Psychological and Statistical Study Based upon the Block-Design Tests.* By S. C. KOHS. New York, Macmillan Co. 1923. pp. xii, 312.

(4) *Measuring Minds: An Examiner's Manual to Accompany the Myers Mental Measure.* By CAROLINE F. MYERS and GARRY C. MYERS. New York and Chicago, Newson and Co. 1921. pp. 55.

(5) *Intelligence Tests and School Reorganization.* By TERMAN, DICKSON, SUTHERLAND, FRANZEN, TUPPER and FERNALD. Yonkers, World Book Co. 1922. pp. viii, 111.

(6) *A Critical Study of Certain Measures of Mental Ability and School Performance.* By INEZ MAY NETERER. Baltimore, Warwick and York. 1923. pp. 141.

(7) *The Will-Temperament and Its Testing.* By JUNE E. DOWNEY. Yonkers, World Book Co. 1923. pp. v, 339.

Intelligence tests of one sort and another continue to appear and to demand attention. One may still scan the newer publications eagerly in the hope of finding a test or tests that rest upon a foundation firmer than the earlier tests. We have reached the point, however, where we may soon expect to discover tests which have a basis other than an empirical one.

The recent theoretical studies of Spearman and Thurston seem to point in this direction. The qualitative tests of intelligence of Lipmann and Bogen evidence the fact that quantitative tests, empirically justified, are but a stage in the development of intelligence measurement.

In the works listed above, with the exception of Downey's work upon the Will-Temperament, we are upon old and familiar ground. In the Herring Revision of the Simon-Binet Tests, we have another adaptation of the Binet material with a number of new tests added. On the whole, the material is more suitable than in the Stanford Revision, and it is more conveniently arranged. Being based upon a point system, rather than in months' credit, it would have been a distinct advance upon the Stanford Revision had it adopted a percentile score rather than a mental age score. There is nothing sacred in the concept of mental age.

A revision of the 1914 edition of the Yerkes-Bridges Point Scale is presented by Yerkes and Foster. There are also given a Point Scale for the Measurement of Intelligence in Adolescent and Adult Individuals and an Infant Point Scale. One gathers that the work has been somewhat hastily put together. The new scales are tentatively presented and are admittedly in need of further standardization and study. There is a real need of a test that should cover the earlier years of the Standard Revision; but is hardly seems that the test will be found in the same sort of verbal tests made use of in the Stanford Revision and also in this Infant Point Scale.

The Block-Design Test of Kohs is a valuable addition to the list of performance tests. It is based upon very careful statistical work and will serve as a useful supplementary test in mental examinations.

The Myers Mental Measure is a "single continuous scale consisting wholly of pictures and applicable to all ages and degrees of school experience. Each section of this test sets tasks easy and simple enough for the kindergarten child and at the same time other tasks hard enough for the student. In this respect it is unique." The authors present graphs and tables which, in their opinion, justify this claim.

The manual upon Intelligence Tests and School Reorganization, edited by Terman, is a description of a few of the experiments that are being carried on in this country with intelligence tests. The practical problems arising from the use of tests in classifying pupils in the public schools and the solutions that have been attempted are described in a very interesting and suggestive manner.

Neterer's monograph is a detailed study of the correlations existing between various intelligence tests, educational measurements and teachers' estimates and school marks. The study was carried on with 329 pupils in Grade 4 B of eight schools in Seattle. The author found "that no one measure provided a basis for the classification of children into groups uniform enough for efficient teaching except in respect to the ability measured by that test or measurement." This is in agreement with previous studies, which have indicated that the most reliable index to be used in classifying pupils can be derived from a combination of intelligence tests, educational tests and teacher's ratings, but that no one of them alone may be used efficiently.

Downey's work with the Will-Profile, and her earlier studies in graphology, which served as a basis for her later work, are well known and hardly need comment. The problem of evaluating qualitatively the reactions of the individual and of presenting the results in terms of their integration, or temperament, is a very difficult one, and in this Downey's work is pioneer. It is to be hoped that she will continue her experimental work in this field, to which she has already made a very marked contribution.

The Defective Delinquent and Insane. By HENRY A. COTTON. Princeton, Princeton University Press. 1921. pp. xvi, 201. (The Louis Clark Vanuxem Foundation Lectures, Princeton University.)

DR. Cotton, the medical director of the New Jersey State Hospital at Trenton, has attacked the traditional attitude of the medical profession towards the insane. He would regard state hospitals for the insane not as custodial asylums, but as institutions where the insane are given the same care and medical attention received in other hospitals; the rôle of the physician cannot be the mere classifying and diagnosing of mental disorders. The medical problem of the insane is the same as any other medical problem: the study of causation and the application of relief. The prevention of insanity, too, is a problem not to be overlooked. With this attitude, the author approaches the problem and gives in this series of lectures the results of his study of the so-called 'functional neuroses.'

The distinction between 'organic' and 'functional' mental disorders can no longer be maintained. Although in organic disturbance pathological changes in the brain have been demonstrated, the absence of pathological changes in the functional group does not signify that these disturbances are purely mental in their causation. "Anatomical investigations have repeatedly shown that conditions which have been classed among the functional diseases possess, in reality, an anatomical basis." "While psychiatrists, in the past, have held the non-biological view of the nature of the so-called functional mental disturbances, the biologists have produced evidence regarding function and structure which when applied to mental disorders will, undoubtedly, modify these traditional ideas. The biologists are definite in the assertion that there can be no function without structure. This being true it would also be true that there can be no abnormal function without a corresponding abnormal structure . . . If we could conceive of a mental state independent of the brain, and all known facts refute such a belief, then we could believe that certain forms of insanity were diseases of the mind and not diseases of the brain." Dr. Cotton expects to find, therefore, some physical cause of functional disorder.

The author regards the doctrine of 'hereditary transmission of mental diseases' as very instable from a scientific standpoint. Eugenicists and sociologists have seized upon the doctrine of the inheritance of insanity; and it is somewhat of a relief, to the reviewer, to find a more scientific attitude to this problem. Tredgold has already pointed out, as regards the inheritance of mental deficiency, that we are dealing with what he terms the 'neuropathic diathesis' and not the direct transmission of certain abnormalities. Dr. Cotton would regard the 'inherited constitution' as the "individual's constitutional resistance to various toxins, rather than to merely mental instability." He finds that hereditary taint exists in only a little more than half of the patients classed in the functional group.

Various factors usually cited as the cause of mental disorder—worry, grief, shock, mental overwork—play an important rôle in the mechanism of the psychoses. These tend to lower the patient's resistance in that loss of appetite, nutritional disturbances and loss of sleep, the result of these psychogenic factors, will cause latent infections, which may be of long duration, to crop out. The emotional reactions, on account of their intimate relation to the endocrine system, probably lower the resistance of an individual so that a latent infection may become active.

Dr. Cotton states: "Psychoses arise from a combination of many factors, some of which may be absent, but the most constant one is an intercerebral, bio-chemical, cellular disturbance arising from circulating toxins, originating in chronic focal infections situated throughout the body and probably to some extent in disturbances of the endocrine system." He would regard the functional psychoses as 'toxic' psychoses, and would include in this group the acute condition of manic-depressive insanity,

the chronic conditions characterized by brain deterioration and grouped under dementia præcox, and paranoia (chronic delusional states). The psychoneuroses—hysteria, neurasthenia and psychasthenia—also respond to toxic treatment.

The primary foci of infection are usually found in the teeth and tonsils, while the secondary foci are located in the gastro-intestinal tract and other internal organs of the body. The reviewer will not here enter into a discussion of the methods of diagnosing infection and the manner in which it responds to treatment. A considerable number of cases in which the removal of the focal infection has resulted in restoring the patients to mental stability are reported in some detail. The success of the work at Trenton may be gathered from the fact that in a few years the percentage of discharged patients to new admissions in the 'toxic' group increased from 40 to 80. During this period, the removal of toxic conditions was the only therapeutic method used. Dr. Cotton regards the psychological study of abnormal mental conditions as of considerable value; but the use of psychotherapy and psychoanalysis does not, in his opinion, produce any marked benefit with 'toxic' psychosis. It may, on the other hand, prove to be dangerous, in that the patient's attention is directed to his mental symptoms which consequently become overemphasized.

Of the three classes of mental defectives, the formative (or congenital), the functional and the traumatic types, Dr. Cotton considers that the functional type, *i.e.*, the emotionally instable and the defective with apparent absence of congenital defect, may be regarded as due to a toxic condition. If this condition be detected early enough, it would respond to treatment in the same manner as the toxic psychosis.

These lectures may be regarded as the report of work in progress. If the writer appears to be too dogmatic upon the subject of focal infections and their relations to mental disturbances usually regarded as purely functional, this may be attributed to a commendable enthusiasm for a point of view and method which have produced very remarkable results. Dr. Cotton links up his theory with Meyer's theory of integration, that is, the theory of the functions of the total person as representing an integration rather than a summation of detachable parts. The psychologist will be interested in the further investigation and elaboration of this point of view. This work represents, in the reviewer's opinion, a new chapter, and a greatly needed one, in the care and treatment of the mentally abnormal.

Cornell University SETH WAKEMAN

NOTES

DR. OBERLY ON "THE RANGE FOR VISUAL ATTENTION, COGNITION AND APPREHENSION"

In a recent number of this JOURNAL,[1] Dr. H. S. Oberly reported the results of a tachistoscopic study. He found three conscious patterns which formed the basis of his *O*s' reports, and which were described as "immediate," "grouping," and "counting." In the "immediate" type the number of dots was immediately perceived. The dots were ungrouped and of an equal and high degree of clearness. In the "grouping" type the number of dots was likewise immediately perceived, but the dots, owing to different degrees of clearness, were grouped into patterns. In the "counting" type the report of number of dots was mediated by 're-imaging' and counting.

Because his characterisations did "not correspond to the systematic categories that have appeared in the literature" Dr. Oberly "transformed

[1] 35, 1924, 332-352.

his results" into attention, cognition and apprehension.[2] For every one of these categories he computed statistical thresholds. The 'transformation' is, however, both incorrect and misleading. It is misleading because the use of the term attention transcends the cognitive field in which the study was made. That the work was upon the cognitive level is attested by Dr. Oberly's instructions to his *Os*: "Immediately after the exposure you will report verbally: (1) the number of dots which you have apprehended; (2) the degree of assurance or certainty of your judgment [measured on a 5-point scale—1 being a "guess or do not know" and 5 the certainty of "a 100 to 1 bet"]; (3) the method of determining your report." To ask an *O* to report the number of dots apprehended, to estimate the degree of certainty of his answer, and to tell the method that he used in making his determinations, is to refer his report to the field of cognition.

The 'transformation' is incorrect because attention is not a cognitive term. While it is true that an attentive consciousness may functionally be cognitive,—as it may also be emotive or volitional,—it is not true, even from the point of view of the functional systems of psychology, that attention may be regarded as a level, step, or degree of cognition. Cognition, furthermore, was not a happy choice for Dr. Oberly's second category; for cognition is not a specific level on the side of awareness or knowledge-about, but is a general term synonymous or co-extensive with awareness or knowledge-about. To restrict the use of the term 'cognition' to the 'grouping' type of his *Os*' reports is to identify the whole with a part.

Preferable terms—if other characterizations than 'immediate,' 'grouping' and 'counting' are needed—would be 'field apprehension,' 'group apprehension' and 'number apprehension.' These three types, however, are not logically co-ordinate. The 'field' and 'group' apprehensions are both immediate, and are both given in a single 'flash' of consciousness; whereas the 'number' apprehensions are mediated by 'subsequent re-imaging' and 'verbal counting.' The first two are of the same kind; 'field' apprehension is merely a limiting case of 'group' apprehension. The two logically fall into one class which stands in opposition to the third. So in reality, Dr. Oberly gives us but two classes, the first of which is divided into two sub-types.

Moreover, the limens were not computed in accordance with the phi-gamma hypothesis, for the reports upon which the calculations were based were selected. "It was arbitrarily determined," Dr. Oberly says, "to use for purposes of calculation only those reports which were *correct* and which

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[2] The 'immediate' reports were 'transformed' into 'attention' because "all the dots were perceived in a single flash of consciousness with an equal and high degree of clearness," and because "this description agrees with the definition of attention as given by Titchener." Nowhere, however, does Titchener define attention as a one-level consciousness. On the contrary, attention for Titchener is a state of consciousness which is divided into the clear and the unclear, as the following quotation from *A Beginner's Psychology* (92) proves: "Whenever our experience shows the patterns of vivid centre and dim background, of bright focus and obscure margin, then we have attention before us." The unclear is as essential to the state of attention as the clear. (*Cf.* Titchener's discussion of attention in *The Psychology of Feeling and Attention*, 1908, 220 ff.; in *A Text-Book of Psychology*, 1909, 266 f.; and his reply to Brits in *Psych. Rev.*, 24, 1917, 56 f.)

The pattern of 'grouping' is 'identified' with 'cognition' because "cognition as it appears in the literature implies" [an] "immediate consciousness" in which "owing to different degrees of clearness there is an attentional grouping of the stimulus dots," and because "Dallenbach found in an experiment on sensory clearness (Cognitive *vs.* Attributive Clearness, *Jour. of Exp. Psych.*, 3, 1920, 182-230; also 4, 1921, 143-163) that two levels were possible, and. . . . . [that] the experiment dealing with two such levels is an experiment in cognition," and because Dallenbach "associates the 'lower level' of clearness (which is the same as expressed by Titchener) with cognition." Dr. Oberly, however, has misread me; for I nowhere make these statements, nor do his conclusions follow from my work. I gave my *Os* a dual instruction. I asked them to give (1) a description of process and (2) a statement of meaning. Under the first instruction the *Os* reported, for every consciousness, two levels of sensory clearness. Under the second instruction the *Os* reported various degrees of cognitive clearness. The results showed that processes at both levels of sensory clearness were cognisable, and that there was no absolute or invariable relation between sensory clearness and cognition; an impression may be attributively clear and at various degrees of cognitive clearness, or an impression may be attributively unclear and at various degrees of cognitive clearness (*op. cit.*, 255 ff.).

had an *assurance of* 5, 4, *or* 3." Unless the number of dots on an exposure card was correctly cognized, and unless "the *O* was sure enough of his report to put even money on it," the experimental result was not considered! Furthermore, the reports "I do not know" were ranked with the doubtful judgments and were placed on the scale of assurance with a "guess."

Dr. Oberly's study is a contribution, not to the psychology of attention, but to the psychology of apprehension. His limens give us merely the ranges of the confident, correct cognitions that are immediate and ungrouped, immediate and grouped, and mediated and counted.

K. M. DALLENBACH

THE MOSCOW INSTITUTE

Friends of Professor G. Tschelpanow, who remember his visit to our American laboratories in 1911, will be glad to have word of him. Professor Tschelpanow tells me that he has retired from the directorship of the Moscow Institute, and is devoting his leisure to the writing of a System of Psychology. He sends the following (officially authorised) account of the activity of the Institute since 1914.

"At the beginning of 1914 I forwarded to you the first volume of the Psychological Researches of the Moscow Psychological Institute. From 1914 to 1917 our work was carried on along almost normal lines; many researches were completed. In order to publish these we founded in 1917 the journal 'Psichologitcheskoie Obosrenie' (Psychological Review), but were able to issue only three numbers in 1917 and 1918. After that and up to now the Institute has been unable to publish its works, this with the exception of very few, some of which appeared in the form of pamphlets while others were printed in German periodicals. In 1918 the Government granted 100,000 Rbls for enlarging the mechanical workshop. The acquisition of apparatus for this sum brought up our workshop to the highest degree of accomplishment. The years 1918 and 1919 were unfavorable for scientific research work, owing to absolute lack of heating.

"In 1920 was opened the section of 'Applied Psychology and Psychology of Labor' on funds provided by the Government. The number of workers and the size of the premises were quite sufficient for the carrying out of this plan.

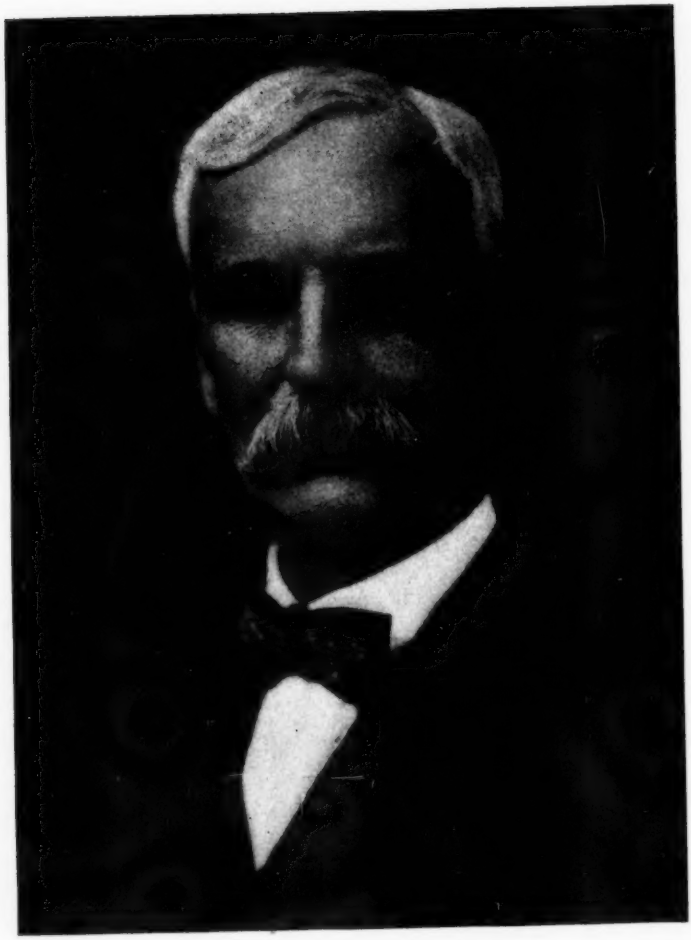
"In 1921, despite enormous technical difficulties, was completed the construction of our 'Universal Psychological Apparatus,' which can be of great interest also to American psychologists and educationalists. A detailed description of this set of apparatus will be forwarded to you in the near future.

"In 1922 the Government undertook the first great reform of the Psychological Institute. This institution was reorganized into a special 'Research Institute,' which was to unite all the psychological establishments in Moscow; the number of collaborators in this organisation reached eighty.

"At present, psychological research in the Institute is conducted by a new staff of psychologists exclusively in the spirit of Marxist Materialism."

E. B. T.

We regret to announce the death, on November 22 last, of Edmund Clark Sanford, head of the department of psychology in Clark University, and for many years an associate editor of the JOURNAL. A sketch of Dr. Sanford's life and work will appear in the next number.



Edmund C. Sanford